LABOUR ANALGESIA- COMPARISON OF EPIDURAL BOLUS ADMINISTRATION OF 0.125% BUPIVACAINE WITH 0.0002% FENTANYL *VERSUS* 0.25% PLAIN BUPIVACAINE

Dissertation submitted to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY

in partial fulfillment for the award of the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

BRANCH X

DEPARTMENT OF ANAESTHESIOLOGY
MADRAS MEDICAL COLLEGE
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CERTIFICATE

This is to certify that the dissertation entitled, **"LABOUR ANALGESIA- COMPARISON OF EPIDURAL BOLUS ADMINISTRATION OF 0.125% BUPIVACAINE WITH 0.0002% FENTANYL *VERSUS* 0.25% PLAIN BUPIVACAINE"** submitted by **Dr. S. Mageshwaran,** in partial fulfillment for the award of the degree of Doctor of Medicine in Anaesthesiology by the Tamilnadu Dr.M.G.R. Medical University, Chennai is a bonafide record of the work done by him in the Department of Anaesthesiology, Madras Medical College, during the academic year 2006 – 2009.

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CONTENTS

INTRODUCTION

Labour is an extremely painful process. Labour pain is of major concern since most parturients experience significant pain of extremely severe intensity. Labour pain can have deleterious effects on the mother, on the foetus and on the labour outcome. Among the current methods of obstetric analgesia, regional analgesia (the most widespread technique being epidural analgesia) offers the best effectiveness/safety ratio[1].

Epidural anaesthesia is an effective means of providing analgesia during labour. The increased availability of epidural analgesia and the favorable experiences of women who have had painless labor with epidural block have reshaped the expectations of pregnant women entering labor[2].

Compared with other forms of pain relief, epidural analgesia is associated with the highest level of maternal satisfaction[3]. Despite providing excellent pain relief during labour, epidural analgesia using local anaesthetic agents alone produce motor block in up to 85% of patients, reduces maternal satisfaction with analgesia, and is associated with a prolonged second stage and increased incidence of instrumental delivery. Epidural opioids offer the possibility of analgesia without motor block but when used alone do not provide satisfactory analgesia throughout labour. Adding an opioid to local anaesthetic solutions can

provide effective analgesia with bupivacaine sparing and a reduction in motor block[4, 5].

The use of either an intermittent bolus or a continuous infusion of local anesthetic (with or without an opioid) is considered to provide similar analgesic efficacy and no measurable outcome differences[3, 6, 7]. The addition of an opioid to the local anesthetic epidural bolus or infusion has become a highly popular technique, and the combination is believed to influence the duration and quality of labor analgesia. The efficacy and duration of epidural opioid alone is considered inferior to epidural local anesthetic, but the benefits of an opioid should outweigh the side effects such as nausea, pruritus, and sedation[3, 8, 9]. An epidural opioid-local anesthetic combination may enhance the duration and quality of pain relief at less intense motor blockade and contribute to the good progress of labor and vaginal delivery[3].

We conducted this study to compare the efficacy of a mobile epidural using 0.125% bupivacaine and 0.0002% fentanyl *versus* a conventional epidural using 0.25% bupivacaine for labour analgesia.

AIM

- To compare the efficacy of epidural analgesia using 0.125% bupivacaine and 0.0002% fentanyl *versus* an epidural using 0.25% bupivacaine alone for labour analgesia.

The following parameters are compared:

- Quality of analgesia (VAS)
- Duration of labour
- Motor block (Bromage score)
- Time from epidural to delivery

HISTORY

Throughout history women suffered with pain until the advent of using ether for labour analgesia by Dr.James Young Simpson of Edinburgh on 19th January 1847, which opened up the interesting avenue of pain relief for labor. At that time it was a highly controversial issue[10, 11, 12].

Labour analgesia became popular when John Snow administered chloroform anesthesia to Queen Victoria for the birth of her 8th child Prince Leopold in 1853 and 9th child Princess Beatrice in 1857. This gave rise to the invention of various methods of regional analgesia[10, 11, 12].

Kinkovich of St.Petersburg used Nitrous Oxide in Obstetric analgesia in 1 880.Guedel designed an apparatus for the self administration of nitrous oxide in labor in 1910[10, 11, 12].

Dennis Jackson and Striker used Trichloroethylene in 1934. Freedman inhaler was developed in 1943 to facilitate administration of analgesic concentrations of Trichioroethylene to women in labor[10, 12].

Methoxyflurane was used for labor in 1959 and in 1970. Even midwives were permitted to use 0.3 5% Methoxyflurane[10, 12].

Tunstall tried Entonox in 1962.Inhalation anesthesia for labor is not much used now except Entonox. Following the demonstration of spinal analgesia by August Bier in 1899 this was also tried for labor but without much success[10, 12].

Stoeckel of Marburg described extradural sacral block in 1909 using Procaine. This was followed by Schlimpert and Schneider who used 50m1 of 1% Procaine. Important contributions to the understanding of the anatomical pathways and physiology of labor pain were provided by Eugen Bagden in 1930 and J.G.P.Clealand of University of Oregon in 1933[10, 12].

Fidel Pages of Spain performed the first lumber epidural block in 1921 and Dogliotti of Turin developed the technique in 1930. Refinements in the needle by Tuohy and in the catheter quality made continuous epidural analgesia a popular technique. The flexibility introduced by the continuous epidural technique with regard to the duration was especially very suitable for labour because of the longer duration required for successful labor analgesia. The CSE technique combines the advantages of both spinal and epidural analgesia[10, 12].

The discovery of opioid receptors in the central nervous system by Snyder in 1973 and Pert in 1976 was soon followed by flurry of activity. A number of opioids have been used successfully both intrathecally and extradurally. Highly lipophilic opioids like Fentanyl, Sufentanil and Alfentanil are more suitable than

less lipophilic drugs like morphine. Opioids provide excellent pain relief when used intrathecally or extradurally without affecting the motor system — a property which is much desired in an agent used for labour analgesia. Nowadays regional analgesia by epidural technique is considered to be the gold standard of labor analgesia[10, 12].

ANATOMY OF THE EPIDURAL SPACE

THE EPIDURAL SPACE[13]

The epidural (extradural, peridural) space is that part of the vertebral canal external to the duramater and its contents. It lies between the duramater and the periosteum lining the canal, and corresponds to the very restricted space within the skull between the two layers of the cranial duramater enclosing the venous sinuses[13].

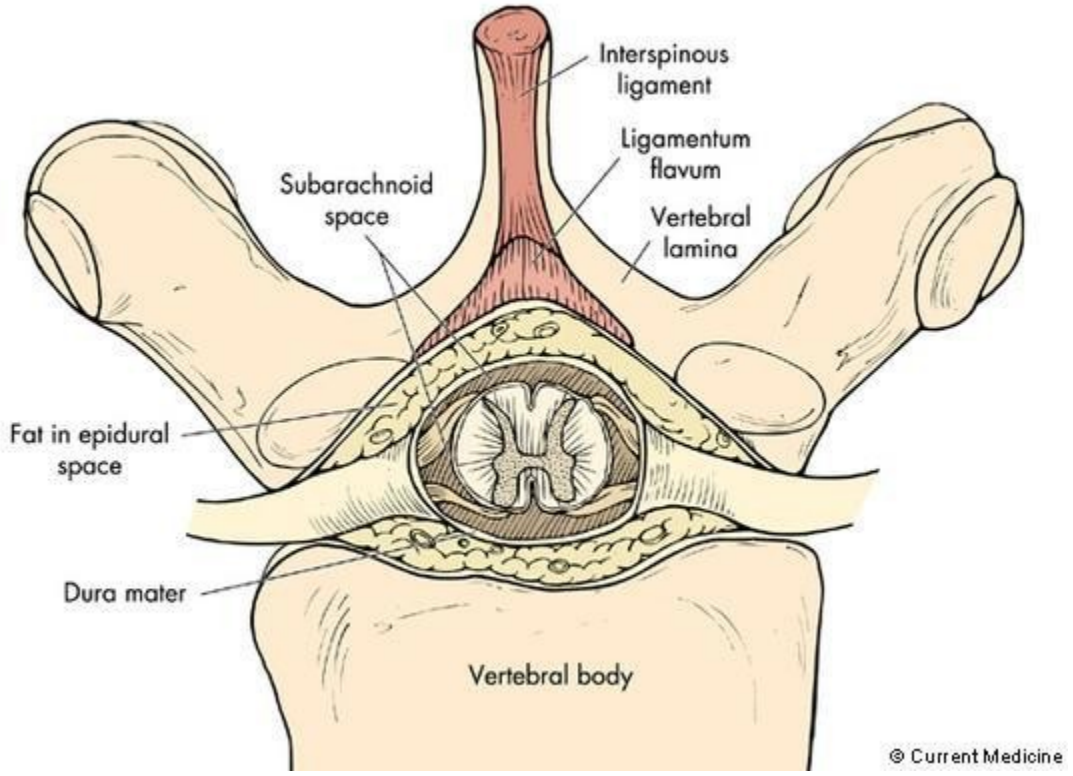


Figure 1. Epidural space.

BOUNDARIES

- ***Anteriorly****:* By vertebral bodies and posterior longitudinal ligaments

- ***Posteriorly***: Vertebral arches and ligamentum flavum
- ***Superiorly***: Fusion of dura with periosteum at foramen magnum
- ***Inferiorly*****:** Sacrococcygeal ligament at sacral hiatus

The epidural space extends from the Foramen magnum to sacral hiatus. Except in the lower sacral region it is annular in shape, and narrow. The anterior and posterior nerve roots with their dural coverings pass across the very narrow

space to unite in the intervertebral foramen to form the segmental nerves. The rest of the epidural space is occupied by numerous small veins and by fatty areolar tissue, which is continuous around the nerves through the intervertebral foramina with the fat in the paravertebral spaces. The upward spread of drugs is limited by the attachment of duramater to the circumference of the foramen magnum[13].

The amount of fat in the areolar tissue of the space depends on the obesity of the subject. It is greatest in the median plane posteriorly where the summit of the vertebral arch is commonly separated from the rounded posterior aspect of the dura by approximately 5 to 6 mm, and antero-laterally where it is continuous with the pads of fat surrounding the spinal nerves in the intervertebral foramina. Between the postero-lateral walls of the lumbar vertebral canal and the dura, the space is narrower, and the fat less evident. Anteriorly in a thin subject, the space

is only potential, since here the dura lies close to the posterior longitudinal ligament on the posterior aspect of the vertebral bodies[13, 14].

The spread of the local analgesic solution injected into the epidural space is not accurately predictable, because of the resistance offered by the fatty areolar tissue and the numerous foramina through which the fluid can leak. A dorso-median fold of dura mater was demonstrated in a few cases, which sometimes

divides the epidural space into a ventral and two dorso-lateral compartments, not necessarily freely communicating with each other. The median thickness of the space might be only 2 mm. These observations explain the occasional patchy analgesia and inadvertent dural puncture when the midline approach is used[13].

The space occupied by the venous plexus varies with the amount of the venous distention and is related to the intra-thoracic pressure[13].

PRESSURE AND VOLUMES OF THE EPIDURAL SPACE

Substantial differences have been observed between the actions of epidural and subarachnoid injections of local anaesthetics in the pregnant and non-pregnant patient. In many respects the changes are thought to be due to the mechanical effects of the pregnancy as the actual size of the space available is reduced. The return of blood from the lower part of the body is mainly via the inferior vena cava; the epidural veins are also involved and they become dilated. This reduces

the space available for the injection of fluid into the epidural space. For the same reason, the subarachnoid space is also reduced. As these veins are an alternate method of returning lower limb blood flow, their use is maximized if there is an obstruction to vena cava return as can happen in pregnancy.

There are three effects from this:

- The volume of local anaesthetic required to provide an extensive block is reduced in pregnancy.

- There is an increased risk of puncture of the distended veins by either the spinal or epidural needles or the catheter.
- Distension is likely to be maximum in the sitting position and pressure in the epidural space is also increased.

For the above reasons pressure in the epidural space is increased, particularly in the sitting position. During a contraction, as the blood expelled from the contracting uterus passes to the epidural venous plexus, the pressure in the epidural space may rise by 4-10 cms H_20. It is for this reason that injections of local anesthetics should be withheld during a contraction, as the spread may be unpredictable and probably excessive. Although the engorgement of the epidural veins would appear to be increased in the sitting position, there is little evidence to suggest that the lateral position is associated with a decrease in complication rates such as dural puncture or reduced incidence of venous puncture.

PHYSIOLOGY OF PAIN IN LABOUR

Pain as described by the International Association for Study of Pain (ISAP) is “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or as described in terms of such damage”[15].

PATHWAYS AND MECHANISM

Pain perception by the parturient is a dynamic process that involves both peripheral and central mechanisms[2, 16].

Many factors have an effect on the degree of pain experienced by a woman during labor, including psychological preparation, emotional support during labor, past experiences, the patient's expectations of the birthing process, and augmentation of labor with oxytocin. An abnormal presentation (such as occiput-posterior) may also cause early labor pain to be more intense. There is, however, no doubt that for most women, childbirth is associated with very severe pain, and it often exceeds all expectations[16]. A study of women in the first stage of labor reported that 60% of primiparous women described the pain of uterine contractions as being "unbearable, intolerable, extremely severe, or excruciating"[17].

The description of peripheral pain pathways proposed by Cleland in 1993 has been modified by Bonica.

PAIN IN THE FIRST STAGE OF LABOUR

During the first stage of labor, pain impulses arise primarily from the uterus. Uterine contractions may result in myometrial ischemia, which ultimately causes the release of bradykinin, histamine, and serotonin. In addition, stretching and distention of the lower uterine segment and cervix may stimulate mechanoreceptors. These noxious impulses follow the sensory nerve fibers that accompany sympathetic nerve endings; they travel through the paracervical region and the hypogastric plexus to enter the lumbar sympathetic chain[18].

Uterine contractions cause stretching, tearing and distortion and possibly ischemia of the uterine tissues, whilst simultaneously dilating the cervix and stretching the lower uterine segment. The intensity of the pain increases progressively with the raising strength of the contractions. In early labor only the nerve roots of T_{11} and T_{12} are involved, but as the intensity of contractions increases, T_{10} and L_1 are recruited[18].

Backache is a frequent complaint during labor and may be caused by one or other of two mechanisms. Pain originating in the uterus or cervix may be referred to the cutaneous branches of the posterior divisions of T_{10}-L_1, which migrate caudally for an appreciable distance before they innervate the skin overlying the vertebral column[19].

PAIN IN THE SECOND STAGE OF LABOUR

The pain caused by the distension of the pelvic structure and perineum following descent of the presenting part is added to the pain of uterine contractions, although once cervical dilatation is complete the pain induced by uterine contractions may become less severe[2]. The uterine pain continues to be referred to T_{10}-L_1, while the pain produced by stretching or pressure exerted on intrapelvic structures, including the peritoneum, bladder, urethra and rectum is referred to sacral segments. Pressure on the roots of the lumbosacral plexus may manifest

itself, as pain felt low in the back or in the thighs. Pain produced by stretching of the perineum is transmitted by the pudendal nerve ($S_{2,3,4}$) and in part by the posterior cutaneous nerve of the thigh($S_{2,3}$), the genitofemoral nerve ($L_{1,2}$) and the ilio-inguinal nerve (L_1)[2, 18].

CLINICAL IMPLICATIONS

During the first stage of labour, a block limited to the T_{11}-T_{12} segments at the beginning and later extending to involve T_{10} and L_1 will usually be sufficient to provide excellent pain relief whilst avoiding neural blockade of the sacral segments. Premature sacral blockade can result in the loss of the stimulating effect upon contractions of Ferguson's reflex and the loss of pelvic muscle tone, which aids the rotation of the presenting part[13].

Later in the first stage and during the early part of the second stage, pain is often experienced in lower lumbar and upper sacral segments, so that the block will have to be extended if analgesia is to be guaranteed[2]. Complete block of the sacral segments need to be performed only when perineal pain becomes worrisome. Epidural block will interrupt the preganglionic sympathetic fibres and leave the postganglionic fibres intact[2].

RELAY OF PAIN[13]

Pain from the peripheral nociceptive field is transmitted to the cortex by the afferents arising from the dorsal root ganglion i.e., the first order neurons. The majority of these first order neurons passes to the contralateral side as the spinothalamic tract and gives afferents to the medullary centre, reticular activating system, hypothalamus and reach the post central gyrus in the cortex. The efferent impulses reach the segmental area through the corticospinal and rubrospinal tracts.

Some of the first order neurons communicate through the intern uncial neurons and give efferent impulses to the peripheral nociceptive areas from the segmental autonomic reflexes.

Labor and vaginal delivery produces tissue damage, and like tissue injury from any cause, result in pain and local segmental, suprasegmental and cortical

responses extended to relieve both uterine pain and pain related to distension of the lower birth canal, thus providing analgesia for instrumental delivery or caesarean sections. Regional analgesia minimizes or completely avoids the problems of maternal aspiration, as well as neonatal drug depression due to general anesthesia[2, 13].

THE STRESS RESPONSE TO PAIN IN LABOUR

Segmental and supra-segmental reflex-responses from the pain of labour may affect respiratory, cardiovascular, gastro-intestinal, urinary and neuro-endocrine functions.

Respiratory - Pain in labour initiates hyperventilation leading to maternal hypocarbia, respiratory alkalosis and subsequent compensatory metabolic acidosis. The oxygen dissociation curve is shifted to the left and thus reduces tissue oxygen transfer, which is already compromised by the increased oxygen consumption associated with labour[20].

Cardiovascular - Labour results in a progressive increase in maternal cardiac output, primarily due to an increase in stroke volume, and, to a lesser extent, maternal heart rate. The greatest increase in cardiac output occurs immediately after delivery, from the increased venous return associated with relief of venocaval compression and the autotransfusion resulting from uterine involution.

Hormonal - Stimulation of pain results in the release of beta-endorphine and ACTH from the anterior pituitary. Associated anxiety also initiates further pituitary response[21].

Pain also stimulates the increased release of both adrenaline and noradrenaline from the adrenal medulla which may lead to a progressive rise in peripheral resistance and cardiac output. Excessive, sympathetic activity may result in

incoordinate uterine action, prolonged labour and abnormal fetal heart-rate patterns. Activation of the autonomic nervous system also delays gastric emptying and reduces intestinal peristalsis.

***Metabolic - Maternal*:** During labour, glucagon, growth hormone, renin and ADH level increases while insulin and testosterone level decreases[21]. Circulating free fatty acids and lactate also increase with a peak level at the time of delivery.

***Fetal*:** Maternal catecholamines secreted as a result of labour pain may cause fetal acidosis due to low placental blood flow[22].

PHYSIOLOGICAL CONSIDERATIONS

Maternal changes in pregnancy occur as a result of hormonal alterations, mechanical effects of the gravid uterus, increased metabolic and oxygen requirements, metabolic demands of the fetoplacental unit, and hemodynamic alterations associated with the placental circulation. Such changes become more significant as pregnancy progresses, and they have major implications for anesthetic management, especially in high-risk parturients[23].

RESPIRATORY SYSTEM

During labour, particularly in the late first stage and second stage, the pain from episodic uterine contractions produce corresponding increases in maternal minute ventilation (as much as 300% over that of non pregnant women) and oxygen consumption[23,24].

The most impressive change in maternal lung dynamics is a decrease in functional residual capacity (FRC), which at term may have changed by as much as 20% of pre-pregnancy values. Minute ventilation increases by 45%, primarily as a result of an increase in tidal volume because the respiratory rate is essentially unchanged. Hormonal changes and an increase in the rate of carbon dioxide production are responsible for the increase in ventilation. Progesterone sensitizes the respiratory center to carbon dioxide. Pa_{CO2} falls to approximately 30 mm Hg by the 12th week of gestation, and it remains at this level for the remainder of pregnancy. Tidal volume increases by 50%, with half of this

increase occurring during the first trimester. The parturient's breathing pattern changes; it becomes more diaphragmatic as pregnancy progresses because of the effects of the gravid uterus and limitation of thoracic cage movement. Closing capacity (CC), however, remains unchanged. The resulting decrease in the FRC/ CC ratio causes faster small-airway closure when lung volume is reduced; thus, parturients can desaturate at a much faster rate than nonpregnant women can. The rapid development of hypoxia as a result of decreased FRC, increased

oxygen consumption, and airway closure may be minimized by administration of 100% oxygen for 3 to 5 minutes before the induction of anesthesia. In an emergency setting, four maximal capacity breaths with 100% oxygen should be sufficient[23].

During pregnancy, capillary engorgement of the mucosa occurs throughout the respiratory tract, potentially causing edema in the nasopharynx, oropharynx, larynx and trachea. Therefore, manipulation of the upper airway requires extreme care. Regional analgesia abolishes the requirement of airway manipulation and hence avoids the dangers involved in general anesthesia[23].

CARDIOVASCULAR CHANGES

The cardiovascular system is progressively stressed during pregnancy and parturition. Many of the changes appear during the first trimester of pregnancy increases in cardiac output of 22% and decrease in systemic vascular resistance

by 30% at 8 weeks gestation). The changes continue into the second and early third trimester of pregnancy, when cardiac output increases to approximately 30-40% of non-pregnant values. The increase in cardiac output during pregnancy is primarily a result of increase in stroke volume (by about 30%) with a more modest increase in heart rate(10-15 beats/mm). Arterial blood pressure does not change during normal pregnancy because of a decrease in peripheral vascular resistance[23].

Parameter	Change	Amount (%)
Heart rate	Increased	20–30
Stroke volume	Increased	20–50
Cardiac output	Increased	30–50
Contractility	Variable	±10
Central venous pressure	Unchanged	—
Pulmonary capillary wedge pressure	Unchanged	—
Systemic vascular resistance	Decreased	20
Systemic blood pressure	Slight decrease	Mid-trimester 10–15 mm Hg, then rises
Pulmonary vascular resistance	Decreased	30
Pulmonary artery pressure	Slight decrease	—

Table 1 -- Cardiovascular changes in pregnancy

Clinical examination of a pregnant woman may reveal a wide, loud split first sound and a soft ejection systolic murmur, caused by the increased blood flow and vasodilatation. The elevated diaphragm usually alters the position of the heart at term, so that the point of maximum impulse is felt a little to the left. The

axis on the ECG is also shifted to left. ECG may show non-specific ST, T and Q wave changes and benign arrhythmias[23].

The pain and apprehension of labor adds to cardiac work during pregnancy and increases stroke volume and cardiac output by 45% over prelabour values. Blood pressure increases during painful labor. Additional stresses are imposed by uterine contractions, which cause, in effect an autotransfusion. With each uterine contraction, blood from the body of the uterus is pushed into the central circulation and blood volume and cardiac output increase by 10-25%. After delivery also the same auto transfusion occurs. In addition to increase in central blood volume, obstruction of the venacava is relieved. As a result there is a marked increase (upto 80% of pre labor values) in stroke volume and cardiac output in the immediate post partum. Patients with limited cardiac reserve may experience cardiac failure at this time[23].

Despite the increase in blood volume and cardiac output, the parturient at term is susceptible to hypotension in supine position. ‘When the patient is supine, the gravid uterus partially or completely compresses the aorta and inferior vena cava, leading to decreased venous return, decreased cardiac output, hypotension and reduced uterine blood flow. Up to 10% of pregnant patients near term develop signs of shock (hypotension, pallor, sweating, nausea, vomiting, changes in cerebration) when they assume this position. Compensatory

mechanisms include increased sympathetic tone and collateral routes (paravertebral veins to azygos vein) to improve venous return during obstruction

of the vena cava. Caval compression also increases uterine venous back pressure, which further decreases uterine blood flow. Compression of the aorta is not associated with maternal symptoms but does cause arterial hypotension in the lower extremities and uterine arteries, which can further decrease uterine blood flow and impair utero-placental perfusion[23].

The anesthesiologist must recognize the importance of the aortocaval compression syndrome and the potential for its adverse effects to be exaggerated by anaesthesia. Drugs causing vasodilatation such as potent inhalational agents and particularly anesthetic techniques causing sympathetic blockade (subarachnoid or epidural anesthesia) exacerbate decreased venous return to the heart when the vena cava is obstructed. Aortocaval compression must be prevented. Displacement of the uterus, off the great vessels can be accomplished by manually displacing the uterus to the left. During labour the patient should be positioned either on her side or with a left tilt. During delivery the operating or the delivery table can be tilted laterally to the left or a small pillow or foam rubber wedge can be used to elevate the patient's right buttock and back to about 10-15 cms[23].

The pregnant woman at term is in a hypercoagulable state owing to increase in factors VII, VIII, X and plasma fibrinogen. Estimation of blood loss at delivery

vary but may be around 500ml for an uncomplicated vaginal delivery. Blood loss during caesarean section varies widely with 500 to 1400 ml, being reported[23].

HEPATIC CHANGES

Total protein concentration and the albumin- globulin concentration ratio decrease. Although plasma cholinesterase activity is reduced during pregnancy and in the immediate post partum period, moderate doses of Succinylcholine are usually metabolized easily[23].

GASTRO INTESTINAL CHANGES

During pregnancy, the secretion of gastric acid increases. During late pregnancy, gastric emptying is slowed as a result of displacement of pylorus by the enlarged uterus. Pain, anxiety and use of opioid analgesia during labor contribute to impaired gastric emptying. Intra-gastric pressure is increased and lower oesopahgeal sphincter tone is decreased during pregnancy. All these changes increase the risk of regurgitation and aspiration during either during general anaesthesia or during the state of impaired consciousness from any other cause[23].

CENTRAL NERVOUS SYSTEM CHANGES

Pregnancy reduces anesthetic requirements both during regional and general anesthesia. During spinal or epidural anesthesia, less local anesthetic is required

to produce a given level of anesthesia. This was thought to be due to the mechanical effects of increased intra-abdominal pressure, causing epidural venous engorgement and a reduction of both the epidural and subarachnoid spaces. Reduced MAC is seen during early pregnancy and immediate post partum period[23].

RENAL CHANGES

Renal blood flow and glomerular filtration rate increase rapidly during pregnancy, reflecting changes in cardiac output. During the third trimester, they slowly return to normal. Creatinine clearance usually increases and therefore the upper limits of normal for blood urea nitrogen and serum creatinine are lower in the pregnant woman[23].

UTERINE BLOOD FLOW

Uterine blood flow in the parturient at term is approximately 700ml/min and is determined by the following relationship:

$$\text{Uterine blood flow} = \frac{\text{(Uterine arterial pressure)-(Uterine venous pressure)}}{\text{(Uterine vascular resistance)}}$$

There is autoregulation of uterine blood flow. The vessels are maximally dilated during pregnancy. As such in the absence of aortic compression, uterine arterial pressure directly reflects maternal blood pressure and cardiac output. Uterine

blood flow decreases during maternal hypotension (sympathetic block, hypovolemia, haemorrhage, compression of the inferior vena cava), in circumstances in which uterine venous pressure is increased (compression of the inferior venacava, abruption placenta), and with increases in uterine vascular resistance (maternal hypertensive disorders, a agonists, uterine hypercontractility). Due to increased maternal mean arterial pressure and a concomitant decrease in uterine blood flow there are deleterious effects on the foetus. After epidural analgesia uterine blood flow increases, mean arterial pressure stabilizes and placental blood flow is increased by either a reduction in extrinsic vascular tone (uterine tone) or a decrease in intrinsic vascular resistance (placental vasodilatation). Conditions that increase the frequency or duration of uterine contractions (e.g. an over dose of oxytocin or abruption placentae) also decrease uterine blood flow[23].

EFFECTS OF LABOUR PAIN ON THE FOETUS

During uterine contractions there is intermittent reduction of the intervillous blood flow and during a peak of contraction, there may be a temporary decrease in the placental gas exchange. This is worsened by maternal hyperventilation due to severe pain. Respiratory alkalosis in the mother results in the following:

- A shift of the mother's oxygen dissociation curve to the left, diminishing transfer of oxygen form mother to the fetus.
- Maternal hypoxia during uterine relaxation.

- Umbilical vasoconstriction causing a diminution of umbilical blood flow.
- A reduction in uterine blood flow due to elevations in noradrenalin levels.
- Fetal hypoxia

Normally maternal blood receives acid metabolites and carbon dioxide from fetal blood and the pH decreases so that there is shift in the maternal oxyhaemoglobin dissociation to the right maintaining increased oxygen delivery to the fetus. At the same time in fetal blood, the pH increases leading to a shift in fetal oxygen dissociation curve to the left. This effect is known as the double Bohr effect. In prolonged labor maternal hyperventilation leads to alkalosis and with diminishing maternal Pa_{CO2}, the Bohr effect may be attenuated and cause hypoxia in conditions of fetal stress. Thus maternal hyperventilation as a result of pain decreases fetal oxygenation, presumably by shifting the maternal oxygen dissociation curve to the left and by reducing umbilical blood flow.

EPIDURAL LABOUR ANALGESIA

Lumbar epidural analgesia offers a safe and effective method of pain relief during laboUr. It is versatile and may be extended to provide anesthesia for instrumental or operative delivery. Low doses of local anesthetic or opioid combinations are administered (usually by infusion) to provide a continuous T_{10}-L_1 sensory block during the first stage of labor. Further supplementation may be required during the late first stage and second stage to achieve a sacral block[2, 23].

The benefits of epidural analgesia include effective pain relief without appreciable motor block, reduction in maternal catecholamines, and a means to rapidly achieve surgical anesthesia[2, 23]. Despite numerous relative contraindications, there are very few absolute contraindications to neuraxial analgesia. Such contraindications include patient refusal, overt maternal coagulopathy, frank infection at the needle site, and maternal haemodynamic instability. Other high-risk conditions, such as fixed cardiac output states (critical aortic stenosis), must be considered on a case-by-case basis, thereby allowing a risk-benefit analysis for each patient[2, 23].

Timing Considerations

It is uncommon for spontaneously laboring parturients to request epidural analgesia before 3 cm of cervical dilation[2]. However, women receiving augmentation of labor with oxytocin may request analgesia at minimal cervical

dilation. It is appropriate to induce epidural analgesia after the diagnosis of active labor has been established and the patient has begun to request pain relief. While epidural block is not contraindicated in advanced labor, it is less common to initiate epidural block when cervical dilation exceeds 8 cm--especially in parous women[25, 26].

Complications of Epidural Analgesia

Immediate

- Hypotension (systolic blood pressure <100 mm Hg or a decrease of 25 percent below preblock average)
- Urinary retention
- Local anestheticinduced convulsions*
- Local anestheticinduced cardiac arrest*

Delayed

- Postdural puncture headache
- Transient backache
- Epidural abscess or meningitis*
- Permanent neurologic deficit*

Note: *--Very rare.

Induction and Maintenance of Analgesia

A method of administering epidural analgesia is outlined in Figure 2. The anesthesiologist's goal during the first stage of labor should be to provide segmental sensory anesthesia of the T_{10}-L_1 dermatomes. The dose of local

anesthetic necessary to achieve effective labor analgesia will depend on the intensity and location of the patient's pain. These in turn depend on the variables discussed earlier, including the amount and rate of cervical dilation; the strength, frequency and duration of uterine contractions; and the position of the fetal head at the time epidural analgesia is requested. Approximately 10 mL of 0.125 to 0.25 percent bupivacaine or 0.125 to 0.25 percent ropivacaine, with or without a small dose of a lipid-soluble opioid (e.g., fentanyl or sufentanil), establishes effective analgesia with minimal motor block. Thereafter, maintenance of epidural analgesia may be achieved with either intermittent bolus injections, continuous epidural infusion or patient-controlled epidural analgesia. In most cases, analgesia may be maintained with a solution of local anesthetic more dilute than that used for induction[2, 27].

The supine position is contraindicated in women receiving epidural analgesia during labor. Compression of the abdominal aorta and the inferior vena cava (aortocaval compression) by the term gravid uterus may concurrently decrease uterine arterial pressure and increase uterine venous pressure. Consequently, uterine perfusion pressure (uterine arterial pressure minus uterine venous pressure) may be substantially reduced even in the presence of normal brachial arterial blood pressure measurements (concealed aortocaval compression). When maternal hypotension occurs during epidural analgesia, it is essential to verify that the patient is not supine[2].

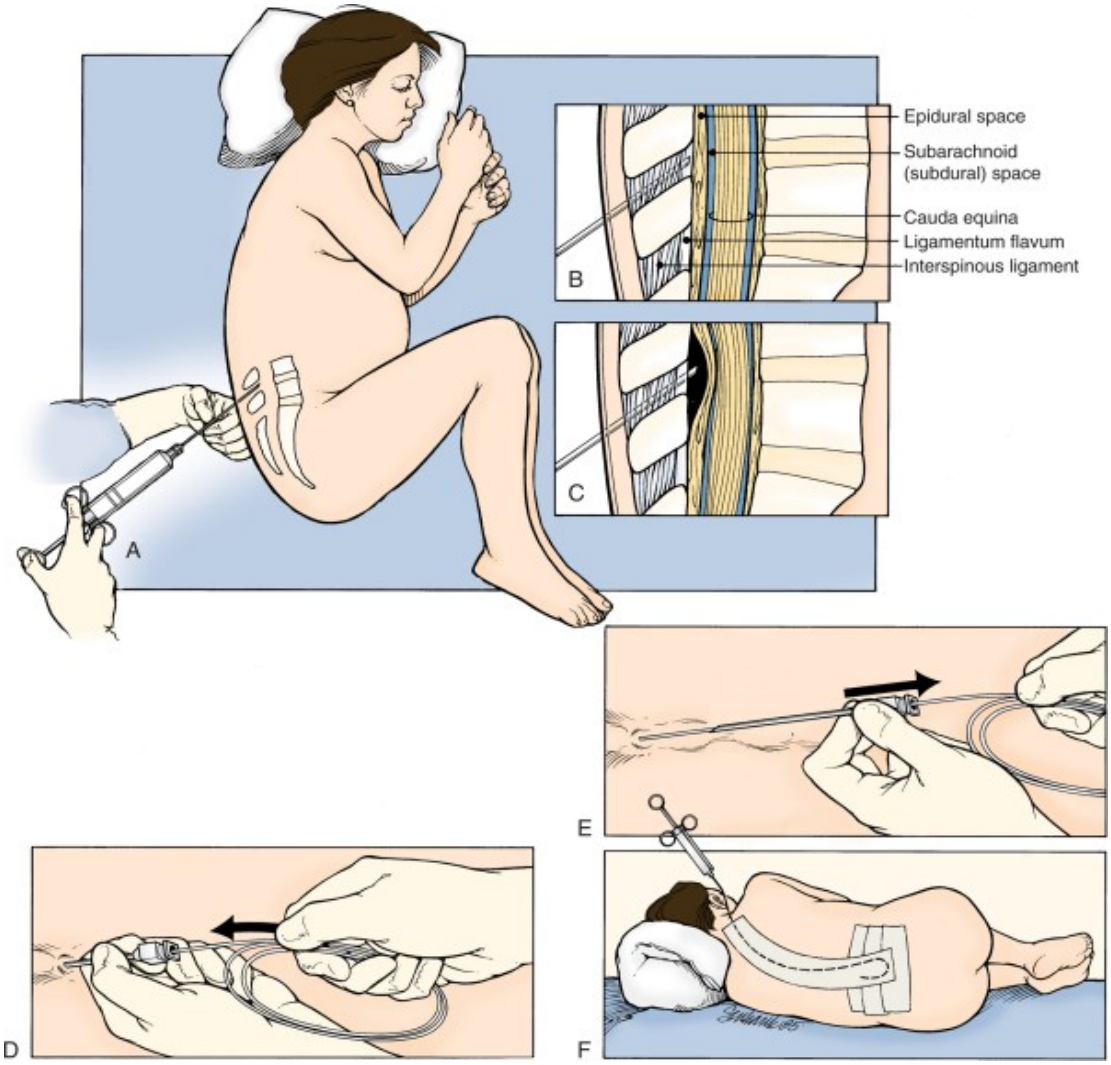


Figure 2. Technique of lumbar epidural puncture by the midline approach.

A, This side view shows left hand held against patient's back, with thumb and index finger grasping hub. Attempts to inject solution while point of needle is in the interspinous ligament meet resistance.

B, Point of needle is in the ligamentum flavum, which offers marked resistance and makes it almost impossible to inject solution.

C, Entrance of the needle's point into epidural space is discerned by sudden lack of resistance to injection of saline. Force of injected solution pushes dura-arachnoid away from point of needle.

D, Catheter is introduced through needle. Note that hub of needle is pulled caudad toward the patient, increasing the angle between the shaft of the needle and the epidural space. Also note technique of holding the tubing: It is wound around the right hand.

E, Needle is withdrawn over tubing and held steady with the right hand.

F, Catheter is immobilized with adhesive tape. Note the large loop made by the catheter to decrease risk of kinking at the point where the tube exits from the skin.

The onset of fetal descent causes substantial distention of the vagina and perineum, typically resulting in severe pain. It is important to ensure that the segmental extent of epidural analgesia has spread to include the S_{2-4} nerve roots to maintain analgesia during this stage of labor. Achieving adequate perineal analgesia is especially important in women in whom episiotomy or the application of forceps is probable. Complaints of rectal pressure with progressive descent of the fetal head should alert the anesthesiologist that sacral analgesia may be inadequate for delivery. Women who progress into the second stage of labor soon after induction of epidural analgesia seldom have adequate sacral blockade and often require additional epidural boluses of local anesthetic before delivery. On the other hand, women who have been receiving continuous epidural analgesia for many hours often have excellent perineal analgesia at delivery[2].

PHARMACOLOGY OF BUPIVACAINE[28]

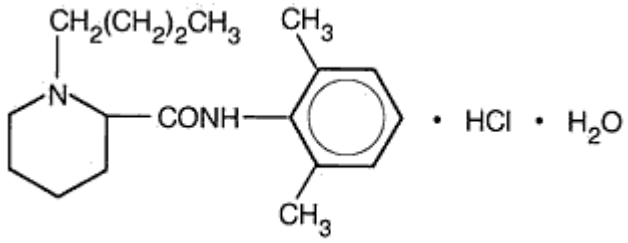
Bupivacaine hydrochloride is a long-acting local anesthetic of the amide type.

HISTORY

It is an amide linked local anesthetic synthesized by B.A.F Ekenstam in 1957 and introduced into clinical practice by Talivuo in 1963.

STRUCTURE

Bupivacaine HCl which is chemically designated as 2-piperidinecarboxamide, 1-butyl-N-(2,6-dimethylphenyl)-, monohydrochloride, monohydrate and has the following structure:



CHEMISTRY

Bupivacaine occurs as a 50:50 racemic mixture of the R- and S-enantiomers and is commercially available as bupivacaine and levobupivacaine, the S-enantiomer of bupivacaine. Bupivacaine hydrochloride is a local anesthetic of the amide type with a long duration of action. Bupivacaine hydrochloride differs structurally from mepivacaine hydrochloride only in the substitution of a butyl group for the N-methyl group. Bupivacaine hydrochloride occurs as a white, odorless, crystalline

powder and is freely soluble in water and in alcohol. The pKa of bupivacaine hydrochloride is 8.1[28].

MECHANISM OF ACTION

The base form is in equilibrium with cationic form outside the axoplasmic membrane. Base form diffuses inside the cell and recalibrates with cationic form. It then reaches the local anesthetic receptor in the Na channel by reversing channel pore while it is in an open state. It prevents Na ions moving intracellularly. In addition to this simple sodium channel blockade, it also affects second messenger system such as adenylate cyclase and guanylate cyclase and also inhibits synaptic transmission by modification of post synaptic receptor (or) presynaptic calcium channel blockade in epidural / subarachnoid blockade.

PHYSIOCHEMICAL PROPERTIES

Property	Value
Molecular weight	288
Potency ratio	15
Toxicity ratio	10
pKa (25.C)	8.16
Protein binding in %	
Maternal	95
Fetal	66
% non ionized at	
pH 7.4	17
pH 7.2	11
Partition co-efficient	
(25.C,pH7.4)	346
Anesthetic index	3.0-4.0

PHARMACOKINETICS OF EPIDURAL BUPIVACAINE[28]

The uptake of local anesthetic into blood vessels in the area where it has been deposited and its subsequent transfer into systemic circulation is referred to as systemic absorption.

ABSORPTION

A biphasic absorption pattern has been found for epidural bupivacaine. The rapid initial absorption following epidural administration is most likely related to high concentration gradient between the drug in the solution and in the blood. In addition profound increases in epidural blood flow observed during epidural administration of bupivacaine may contribute to its fast initial absorption rate. Later on, after the local anaesthetic has been taken up into local tissues such as epidural fat, absorption will become dependent on tissue blood partitioning, resulting in marked slowing of absorption. Estimated total fraction of the dose ultimately absorbed into general circulation is 0.94 with mean absorption time 8.6 hours.

Absorption of local anesthetic is directly related to the amount of drug injected, vascularity, site injected and tissue binding of local anesthetic at injection site. Bupivacaine will produce lower C_{max} than less potent and less lipid soluble agents.

DISTRIBUTION

Distribution of local anesthetic has special emphasis in the pregnant patient, because one of the organs that will be exposed to the absorbed drug is fetoplacental unit.

PHARMACOKINETICS OF BUPIVACAINE

Elimination half life $t_{½}$ - 162 minutes

Volume of distribution VDSS - 73 lit

Clearance (lit/min) - 0.6

Hepatic extraction - 0.4

BIODEGRADATION AND ELIMINATION

Liver is the site of metabolism. Two major factors controlling the clearance of the amide linked local anesthetic are hepatic blood flow and hepatic function. The principal pathways are N-dealkylation, aromatic hydroxylation and amide hydrolysis.

CLINICAL CHARACTERISTICS OF BUPIVACAINE

Property	Value
Penetrance	Moderate
Duration	6-8 hrs
Infiltration	0.05%
Field block	0.1%
Pudendal/paracervical	0.125%
Epidural analgesia	0.125-0.25%
Extradural motor	0.5-0.75%
Maximal dose	2mg/kg body weight

ADVERSE EFFECT AND COMPLICATIONS[28]

Central Nervous System Toxicity

Potentially toxic blood level can occur when a drug is injected intravenously, intra arterially or a large dose of drug is given into highly vascular area. Risk of CNS toxicity is more because bupivacaine is a highly protein bound drug. Pregnancy is associated with 30% reduction in protein binding. This allows for higher brain level of bupivacaine for a given dose of drug.

Symptoms

Slow speech, jerky movements, tremors, hallucination, and seizure.

Cardiovascular Toxicity[29, 30]

1. Dose dependant depression of contractility
2. Dose dependent depression of conduction and velocity in all conducting tissues. Progressive prolongation of ventricular conduction.
3. Predisposition to reentry phenomenon followed by sudden onset of ventricular fibrillation.
4. More affinity for cardiolipin

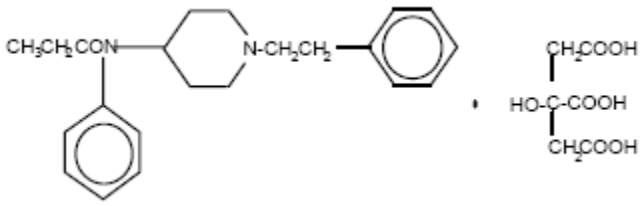
Toxic plasma concentration is 4-5 µg/ml

PHARMACOLOGY OF FENTANYL[31]

Fentanyl is a synthetic phenylpiperidine-derivative opiate agonist.

STRUCTURE

Fentanyl citrate is N-(1-Phenethyl-4- piperidyl) propionanilide citrate (1:1). Fentanyl is a highly lipophilic compound that is freely soluble in organic solvents and sparingly soluble in water (1:40). The molecular weight of the free base is 336.5 (the citrate salt is 528.6). The pKa of the tertiary nitrogens are 7.3 and 8.4. The compound has the following structural formula:



PHARMACODYNAMICS OF FENTANYL[31]

CARDIOVASCULAR SYSTEM

Bradycardia — vagal stimulation in high doses.

No effect on cardiac contractility

Hypotension in large doses due to bradycardia, venodilation and suppression of central sympathetic out flow.

RESPIRATORY SYSTEM

Dose dependent respiratory depression through direct action on medullary respiratory centre.

Apnoeic threshold increased.

Hypoxic drive decreased

Delayed respiratory depression.

CENTRAL NERVOUS SYSTEM

Analgesia, euphoria, sedation, hyponosis, miosis, nausea, vomiting.

Gastrointestinal tract: Delays gastric emptying, produces biliary colic.

Endocrine system: Attenuation of stress response

PHARMACOKINETIC / PHYSIOCOCHEMICAL PROPERTIES

Property	Value
pKa	8.4
% unionized at pH 7.4	<10
Percentage bound to plasma protein	84
t ½ μ	l-2mins
t ½ α	10-30mins
t ½ β	2-4hour
Vdcc L/kg	0.5 - 1.0 L /Kg
Vdss L/kg	3-5 L/kg
Clearance	10-20 ml/kg/mt
Hepatic extraction ratio	0.8-1.0

CLINICAL PROPERTIES

- Minimal CSF spread
- Rapid onset
- Short duration
- Low CSF solubility Rapid analgesia
- Decreased side effects

- Ideal for PCEA

DISADVANTAGES

- Systemic absorption
- Brief single dose analgesia

When applied intraspinally these opioids should be injected as close as possible to the spinal segments where the previous nociceptive afferent, carrying the nociceptive impulses from the involved dermatomes enter the spinal cord. When this is accomplished small doses of the drug will produce significant analgesia.

PHARMACOLOGY OF EPIDURAL FENTANYL

Dose = 50 -200 µg

Onset = 5—15 minutes

Duration = 2 —4 hours after single dose

SIDE EFFECTS

Pruritus, sedation, nausea and vomiting, urinary retention, apnoea and seizures, chest wall rigidity.

FACTORS ASSOCIATED WITH RESPIRATORY DEPRESSION

Elderly, poor general condition, concomitant use of other drugs (CNS depressants), the use of hydrophilic opioids.

REVIEW OF LITERATURE

1. *Comparison of epidural bolus administration of 0.25% bupivacaine and 0.1% bupivacaine with 0.0002% fentanyl for analgesia during labour*[5].

In a double-blind, randomized, controlled study, comparison of epidural bolus administration of 0.25% bupivacaine and 0.1% bupivacaine with 0.0002% fentanyl for analgesia during labour was done. Patients were randomized to enter either group A treatment arm or group B treatment arm. Group A received 10-ml bolus doses of 0.1% bupivacaine with fentanyl 2 micrograms/ml while group B received 0.25% plain bupivacaine 10 ml. Analgesia provided by both techniques was found to be similar. Women in group A retained motor power in their legs and 60% chose to get out of bed. Duration of labour and time from insertion of the epidural to delivery was similar in both groups, but in group A, duration of the second stage was significantly shorter (p = 0.0003; 95% confidence interval (CI) -1.17, -0.27 h) and the incidence of forceps delivery was lower (p = 0.032). In addition, maternal satisfaction with epidural analgesia, as assessed by VAS, was higher in group A (p = 0.04; 95% CI -0.001, 10.001)[5].

2. *A comparison of minimum local anesthetic volumes and doses of epidural bupivacaine (0.125% w/v and 0.25% w/v) for analgesia in labor*[32].

Bupivacaine 0.125% (w/v) when compared with 0.25% (w/v) produced equivalent analgesia with a 50% increase in volume, but with a 25% reduction in dose. Any reduction in dose, without loss of efficacy, reduces risk of toxicity and improves safety[32]. A study was conducted to determine and compare the minimum local

anesthetic volumes (MLAV) and doses (MLAD) of two concentrations of bupivacaine for epidural pain relief in labor, and to quantify the effect on dose. Eighty women were randomized in a double-blind manner to receive a first bolus of either plain bupivacaine 0.125% (w/v) or 0.25% (w/v). The arbitrary starting volume was 15 mL. Subsequent volumes were decided by sequential allocation according to analgesic efficacy. A visual analog pain score < or =10 (0-100) within 30 min, indicated effective analgesia. The next woman received a decrement of 2 mL. A failure of the visual analog pain score to reach < or =10 was followed by a 2 mL increment for the next woman. Using the formula of Dixon and Massey, MLAV and MLAD, with 95% confidence intervals (CI) were calculated for each concentration. MLAV was 13.6 mL (95% CI 12.4-14.8), with bupivacaine 0.125% (w/v), and 9.2 mL (95% CI 6.9-11.5) with bupivacaine 0.25% (w/v). The difference was highly significant (P = 0.002). MLAD for these volumes were 17.0 mg (95% CI 15.5-18.5), and 23.1 mg (17.2-28.9), respectively (p = 0.045)[32].

3. *A randomized comparison of programmed intermittent epidural bolus with continuous epidural infusion for labor analgesia*[33].

Bolus injection through an epidural catheter may result in better distribution of anesthetic solution in the epidural space compared with continuous infusion of the same anesthetic solution[33]. In a randomized, double-blind study, comparison of total bupivacaine consumption, need for supplemental epidural analgesia,

quality of analgesia, and patient satisfaction were assessed in women who received programmed intermittent epidural boluses (PIEB) compared with continuous epidural infusion (CEI) for maintenance of labor analgesia. The primary outcome variable was bupivacaine consumption per hour of analgesia. Combined spinal epidural analgesia was initiated in multiparas scheduled for induction of labor with cervical dilation between 2 and 5 cm. Subjects were randomized to PIEB (6-mL bolus every 30 min beginning 45 min after the intrathecal injection) or CEI (12-mL/h infusion beginning 15 min the after the intrathecal injection). The epidural analgesia solution was bupivacaine 0.625 mg/ mL and fentanyl 2 microg/mL. Breakthrough pain in both groups was treated initially with patient-controlled epidural analgesia (PCEA) followed by manual bolus rescue analgesia using bupivacaine 0.125%. The median total bupivacaine dose per hour of analgesia was less in the PIEB (n = 63) (10.5 mg/h; 95% confidence interval, 9.5-11.8 mg/h) compared with the CEI group (n = 63) (12.3 mg/h; 95% confidence interval, 10.5-14.0 mg/h) ($p < 0.01$), fewer manual rescue boluses were required (rate difference 22%, 95% confidence interval of difference 5% to 38%), and satisfaction scores were higher. Labor pain, PCEA requests, and delivered PCEA doses did not differ. PIEB combined with PCEA provided similar analgesia, but with a smaller bupivacaine dose and better patient satisfaction compared with CEI with PCEA for maintenance of epidural labor analgesia[33].

4. *0.125% ropivacaine is similar to 0.125% bupivacaine for labor analgesia using patient-controlled epidural infusion*[34].

0.125% ropivacaine is similar to 0.125% bupivacaine for labor analgesia using patient-controlled epidural infusion[34]. A study compared the effects of 0.125% ropivacaine with 0.125% bupivacaine in laboring patients using patient-controlled epidural analgesia (PCEA). Fifty-one ASA physical status I or II term parturients with functioning epidural catheters were randomized to receive ropivacaine or bupivacaine using a prospective, double-blind design. Basal infusions (6 mL/h) were supplemented with patient-controlled boluses (5 mL) every 10 min as required. For inadequate analgesia, patients were administered 10-mL boluses of study solution until comfortable. There were no differences in verbal pain scores, amount of local anesthetics used, sensory levels, motor blockade, labor duration, mode of delivery, side effects, or patient satisfaction between the two local anesthetics. Results showed that 0.125% ropivacaine and bupivacaine are clinically indistinguishable and are both highly effective for labor analgesia using PCEA[34].

***5. Local anesthetics and mode of delivery: bupivacaine versus ropivacaine versus levobupivacaine*[35].**

Bupivacaine, ropivacaine, and levobupivacaine all confer adequate labor epidural analgesia, with no significant influence on mode of delivery, duration of labor, or neonatal outcome[35]. A clinical study was conducted to determine if there is a

difference in mode of delivery among parturients who receive epidural bupivacaine, ropivacaine, or levobupivacaine. Nulliparous women at term requesting labor analgesia with a cervical dilation <5 cm were randomized to receive epidural bupivacaine, ropivacaine, or levobupivacaine. Analgesia was initiated with a bolus of 15 mL of 0.0625% of the assigned LA with fentanyl 2 microg/mL. Analgesia was maintained with an infusion of the same solution at 10 mL/h. The primary endpoint was the operative delivery rate (instrumental assisted vaginal delivery plus cesarean delivery). Ninety-eight women received bupivacaine, 90 ropivacaine, and 34 levobupivacaine. There was no significant difference in the operative delivery rate (bupivacaine = 46%, ropivacaine = 39%, and levobupivacaine = 32%, p = 0.35) among groups. There was less motor block in the levobupivacaine group when compared with the ropivacaine and bupivacaine groups, p < 0.05. There was no significant difference in the duration of the first or second stage of labor, the total dose of LA received per hour of labor, or neonatal outcome among groups[35].

6. Rates of caesarean section and instrumental vaginal delivery in nulliparous women after low concentration epidural infusions or opioid analgesia: systematic review[36].

Epidural analgesia using low concentration infusions of bupivacaine is unlikely to increase the risk of caesarean section but may increase the risk of instrumental vaginal delivery. Although women receiving epidural analgesia had a longer second stage of labour, they had better pain relief[36].

7. The site of action of epidural fentanyl infusions in the presence of local anesthetics: a minimum local analgesic concentration infusion study in nulliparous labor[37].

Coadministered epidural fentanyl infusions were more than three times more potent than IV fentanyl infusions, suggesting a predominantly spinal mechanism of opioid action[37]. Forty-eight nulliparous women in active labor participated in a prospective, randomized, double-blinded study. Women received lumbar epidural analgesia with 20-30 mL bupivacaine 0.125% until pain free. Subjects were then randomized to either IV or epidural (EPI) fentanyl infusion groups. Each infusion delivered fentanyl 30 micrograms/h. All women received an epidural infusion of bupivacaine at a rate of 20 mL/h, the concentration of which was determined by the response of the previous woman in the same group to the analgesic regimen used. Unlike previous studies that assessed the minimum local analgesic concentration (MLAC) for bolus administration at the initiation of analgesia, this study assessed MLAC (infusion) for the maintenance of analgesia throughout the first stage of labor. MLAC (infusion) was determined using the up-down sequential analysis described by Dixon and Massey. The MLAC (infusion) of epidural bupivacaine was 0.063% (95% confidence interval, 0.058-0.068) and 0.019% (95% confidence interval, 0.000-0.038) in the IV and EPI groups respectively. A continuous infusion of fentanyl was more than three times more potent when administered by the epidural than by the IV route. This marked increase in potency for the epidural route is highly suggestive for a predominantly

spinal mechanism of action for infused epidural fentanyl under the conditions of this study[37].

8. Epidural analgesia with 0.15% ropivacaine plus sufentanil 0.5 microgram ml-1 versus 0.10% bupivacaine plus sufentanil 0.5 microgram ml-1: a double-blind comparison during labour[38].

Combined with sufentanil 0.5 microgram/ml, 0.10% bupivacaine and 0.15% ropivacaine produce effective and equivalent analgesia during labour, with similar incidences of motor block[38]. A double-blind, randomized, prospective study was performed in 140 parturients who requested epidural analgesia. After a lumbar epidural catheter had been placed, patients received either 0.10% bupivacaine plus sufentanil 0.5 microgram ml-1 or 0.15% ropivacaine plus sufentanil 0.5 microgram ml-1 followed by a continuous infusion. Additional boluses were used for inadequate levels of analgesia. Visual analogue pain scores, motor block, level of sensory block, supplementary boluses and main characteristics of labour were recorded. No differences were observed between the two groups for pain scores, total volume of anaesthetic solution used [59 (23) and 57 (24) ml in the bupivacaine and ropivacaine groups respectively], duration of labour, mode of delivery, side-effects or satisfaction score. The incidence of motor block was not statistically different between the groups (54 and 69% in the bupivacaine and ropivacaine groups respectively, p = 0.07). However, when motor block occurred,

survival analysis showed that it occurred sooner in the course of labour with ropivacaine compared with bupivacaine (log rank test, p = 0.012)[38].

9. Single-dose intrathecal analgesia to control labour pain: is it a useful alternative to epidural analgesia?[39]

Physicians practising modern obstetrics in rural and small urban centres might find single-dose intrathecal narcotics [ITN] as a useful alternative to parenteral or epidural analgesia for appropriately selected patients[39]. To examine the safety and efficacy of single-dose spinal analgesia ITN during labour, MEDLINE was searched and the references of 2 systematic reviews and a meta-analysis were reviewed to find articles on obstetric analgesia and pain measurement. The 33 articles selected included 14 studies, 1 meta-analysis, and 2 systematic reviews, all providing level I evidence. The literature supports use of ITN as a safe and effective alternative to epidural anaesthesia. The recent decrease in rates of episiotomies and use of forceps during deliveries means patients require less dense perineal anesthesia. The advantage of single-dose ITN is that fewer physicians and nurses are needed to administer it even though its safety and effectiveness are comparable with other analgesics. Use of ITN is associated with a shorter first stage of labour and more rapid cervical dilation. A combination of 2.5 mg of bupivacaine, 25 microgram of fentanyl, and 250 microgram of morphine intrathecally usually provides a 4-hour window of acceptable analgesia for patients without complications not anticipating protracted labour[39].

10. Case report: Successful labour epidural analgesia in a patient with spinocerebellar ataxia[40].

A favourable outcome was found to be associated with epidural analgesia in a parturient with spinocerebellar ataxia (SCA). A 34-yr-old patient, G_2 P_0, presented at term with a history of SCA since the age of 22 characterized by slurred speech, balance and gait disturbances, diplopia and nystagmus. Neurological examination revealed an unsteady, wide-based gait, nystagmus, mild dysarthria, moderate finger to nose ataxia, absent reflexes in all upper and lower limbs, sensory loss to vibration and temperature discrimination up to the level of both knees, and normal motor strength. The patient presented for induction of labour at 40 weeks and requested epidural analgesia, which was performed in the usual manner. Following a negative test dose of 3 mL of 2% lidocaine, a loading dose of 10 mL of 0.125% bupivacaine was administered, and maintenance of analgesia was achieved with a mixture of bupivacaine 0.0625% and fentanyl 2 microgram/mL. The patient required standard doses of the epidural mixture, and experienced effective analgesia for labour and delivery. Her recovery was uneventful and no subsequent neurological deficit was detected up to two years after delivery[40].

After going through these references, we decided to compare the efficacy of a mobile epidural using 0.125% bupivacaine and 0.0002% fentanyl *versus* a conventional epidural using 0.25% bupivacaine for labour analgesia.

MATERIALS AND METHODS

Study Centre

Institute of social obstetrics, Kasturba Gandhi Hospital, Madras Medical College, Chennai.

Study Design

Randomised, Prospective, Comparative, Parallel group study.

Study Period

August 2008 to November 2008.

Study Population

Fifty parturients who were admitted to the antenatal ward and who requested pain relief during labor and who fulfilled the recruitment criteria were selected for the study. The procedure was explained to them in detail and written consent was obtained from them.

Ethical Requirement

The study was performed in accordance with the principles stated in the Declaration of Helsinki. Ethical approval of the study protocol was obtained from the Ethics Committee at the Institution before the study was undertaken.

Informed Consent

Written informed consent was obtained from each patient in the prescribed format prior to performance of any study related procedures: before physical examination, laboratory screening or any other investigational procedure and before administration of any study related medication. The patients were given full information about the nature, procedure and importance of the study.

Inclusion Criteria

- ASA Status I & II
- Females in the age group from 18 to 30 years
- Primigravida
- Adequate gynaecoid pelvis
- Cervical dilatation less than 4 cm

Exclusion Criteria

- Patient refusal
- Patients with pregnancy induced hypertension, heart disease, anaemia and other complications of pregnancy
- Cervical dilatation greater than 4 cm
- Patients who received systemic opioids within 4 hours of epidural request
- Coagulopathy

- ❖ Patients with clinically significant renal, hepatic, cardiovascular, haematopoetic, pulmonary, gastrointestinal, nervous or endocrine disorders
- ❖ Patients unwilling or unable to comply with the study procedures

Study Procedures

After obtaining approval from the Institutional Ethics Committee and written informed consent, 50 women fulfilling the inclusion criteria who required epidural analgesia in labour were studied.

IV access was secured but no IV fluid load was given. The patients were shifted to the operation theatre for insertion of the epidural catheter in aseptic manner. An epidural catheter was sited at the second lumbar interspace using a standard midline technique with an 18-gauge Tuohy needle. Patients entered in to the study in a randomized order to receive one of the study treatments.

The procedure was clearly explained to the patient. The visual analog scale was shown to them and interpretation of the scale explained in detail. Anaesthesia machine was checked and all emergency airway equipments like laryngoscopes, blades of different sizes, endotracheal tubes, LMAs, oropharyngeal airways were kept ready. An emergency drug tray containing all the emergency drugs was also kept ready.

Patient's vital parameters like heart rate, blood pressure, respiratory rate and fetal heart rate were continuously monitored during the procedure. The base line values were recorded. The drugs to be administered epidurally were prepared and stored in a sterile container.

Equipment

The needles used for both groups were of Vygon make (17G Tuohy epidural needle and 19G epidural catheter)

Procedure

With the patient in left lateral position, under aseptic precaution L_2-L_3 interspace was identified and skin infiltration was done with 1.5 ml of 2% lignocaine. Using a 17G Tuohy needle and 'loss of resistance to air' technique the epidural space was identified.

After confirmation by negative aspiration test 19G epidural catheter was inserted and 5 cms kept inside the epidural space. The catheter was tapped firmly to the back. The patient was turned to supine position. After negative aspiration of blood and CSF the initial dose of LA solution given in divided doses.

A standard epidural test dose itself will result in augmentation of motor blockade. Further, addition of epinephrine to confirm intravascular placement is not reliable in active labor. Hence test doses were done away with. Rather the

bolus dose itself was given in divided doses with 5 mins interval checking for motor block after the first dose.

Epidural top-ups were not given till patient complained of pain or discomfort. With the catheter in place patients were shifted to the labor ward, where they were closely monitored till delivery.

PROCEDURE FOR GROUP–A 0.1% BUPIVACAINE WITH FENTANYL

★IV access

★Monitors

★***Technique***:

An epidural catheter was sited at the second lumbar interspace using a standard midline approach with loss of resistance technique

★15 ml of 0.1% bupivacaine with fentanyl 50 micrograms and maintained on maternal request with bolus doses of 10ml of 0.1% bupivacaine with fentanyl 2 micrograms/ml

PROCEDURE FOR GROUP B – 0.25% plain bupivacaine

★IV access

★Monitors

★***Technique***:

An epidural catheter was sited at the second lumbar interspace using a standard midline approach with loss of resistance technique

★15ml of 0.25% of plain bupivacaine and maintained with 10 ml bolus doses of 0.25% plain bupivacaine

PARAMETERS THAT WERE COMPARED

★Analgesia was measured using visual analogue scores (VAS) on a 100 mm line. Measurements were performed every 10 minutes until analgesia was established and at 30 min and 1 hr after the initial dose. Thereafter 2 hourly VAS were recorded until delivery.

★Motor Power was assessed using a modified Bromage score 30 mins after each top-up and at each request to get out of bed (score **0** = no weakness, able straight leg raise against resistance, **1** = not able to straight leg raise, able to flex knee, **2** = unable to flex knee, able to flex ankle, **3** = unable to move lower limb.

★Mode of delivery was recorded, as were time intervals between top-ups, duration of first and second stages of labour, and time from insertion of epidural until delivery.

★Tolerability was assessed by checking for complications like dural puncture, venous puncture, pruritus, nausea, vomiting, rigor, drowsiness, urinary retention, hypotension, respiratory depression.

Statistical report

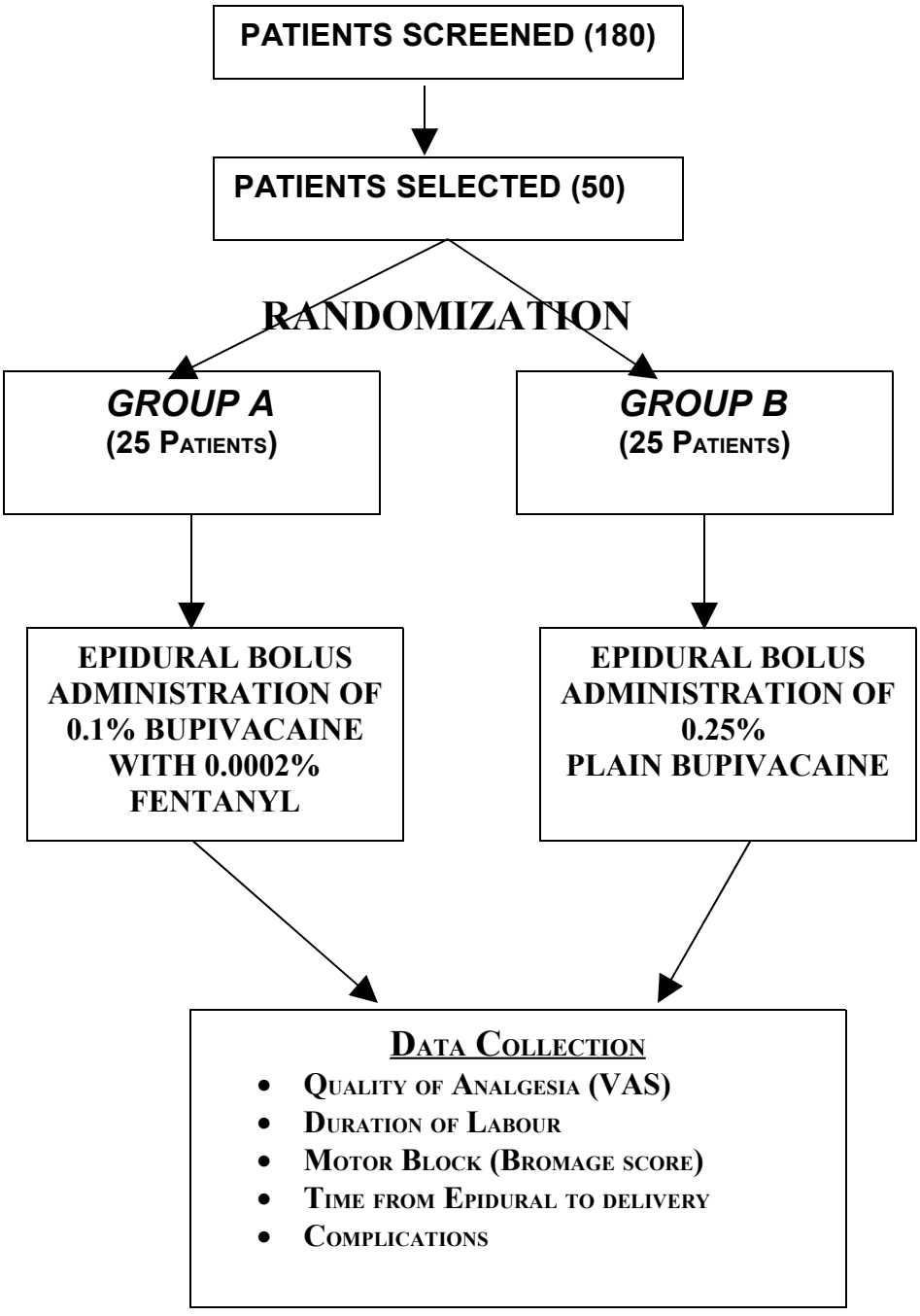
Data were analysed using SPSS 11.5. Descriptive analysis for non-parametric variables was expressed in *proportion* and parametric variables in *mean* and *standard deviation*. The treatment difference was assessed using *t test* for independent samples for parametric variables and by *Chi square test* for non-parametric variables. Statistical significance was assessed using p at 0.05 cut off or 95% confidence interval. (95% CI).

RESULTS

A total of **180** patients were screened for the study. **50** patients who fulfilled the inclusion criteria were enrolled for the study and were divided in to two groups -

- **GROUP A**: 25 patients
- **GROUP B**: 25 patients

Patients were randomly allocated to groups A or B to receive either of the two study therapies –either epidural bolus administration of 0.1% bupivacaine with 0.0002% fentanyl (**Group A**) or epidural bolus administration of 0.25% plain bupivacaine (**Group B**). All patients in both the groups completed the study. There were no drop outs in the study. The following flow chart explains the progress of participants through the trial.


PATIENTS SCREENED (180)
PATIENTS SELECTED (50)
RANDOMIZATION
GROUP A
(25 PATIENTS)
GROUP B
(25 PATIENTS)
EPIDURAL BOLUS ADMINISTRATION OF 0.1% BUPIVACAINE WITH 0.0002% FENTANYL
EPIDURAL BOLUS ADMINISTRATION OF 0.25% PLAIN BUPIVACAINE
DATA COLLECTION
QUALITY OF ANALGESIA (VAS)
DURATION OF LABOUR
MOTOR BLOCK (BROMAGE SCORE)
TIME FROM EPIDURAL TO DELIVERY
COMPLICATIONS

PHYSICAL CHARACTERISTICS

Physical characteristics like age, height and weight were comparable in both the groups.

AGE DISTRIBUTION

The age distribution in both groups are shown in the table below.

Table 2- Age distribution

Age distribution	Group - A	Group - B
< 20	9	10
20-30	16	15
Total	25	25
Mean ± SD	21.2000 ± 2.533	20.0800 ± 1.824
T-test value	1.79	
P value (Using Student T-test)	0.037	

WEIGHT DISTRIBUTION

The distribution of weight in both the groups are shown in Table 2. The values are similar in both groups and are statistically comparable. The Student T test done on the values revealed no statistical significance.

Table 3- Weight distribution

Weight frequency	Group - A	Group - B
50-59	5	5
60-69	17	14
70-79	3	6
Mean ± SD	64.44 ± 5.58	64.68 ± 5.71
T-test value	0.15	
P value (Using Student T-test)	0.862 (Not Significant)	

HEIGHT DISTRIBUTION

The distribution of weight in both the groups are shown in Table 4. The values are similar in both groups and are statistically comparable. The Student T test done on the values revealed no statistical significance.

Table 4- Height distribution

Height frequency	Group - A	Group - B
50-59	1	3
60-69	17	16
70-79	7	6
Total	25	25
Mean ± SD	158.32 ± 4.63	156.84 ± 5.93
T-test value	0.98	
P value (Using Student T-test)	0.317 (Not Significant)	

MODE OF DELIVERY

One patient in Group A and two patients in Group B were delivered by Caesarean section. The indication for Caesarean section was failure to progress in labour. Two patients in Group B were delivered by outlet forceps delivery. The indication for forceps delivery was maternal exhaustion. All others were delivered by Labour Natural with episiotomy.

Table 5- Mode of Delivery

Mode of Delivery	Group - A	Group - B
Labour Natural	24	21
Caesarean section	1	2
Outlet forceps	-	2
Chi-Square value	2.53333	
P value	0.28177 (Not Significant)	

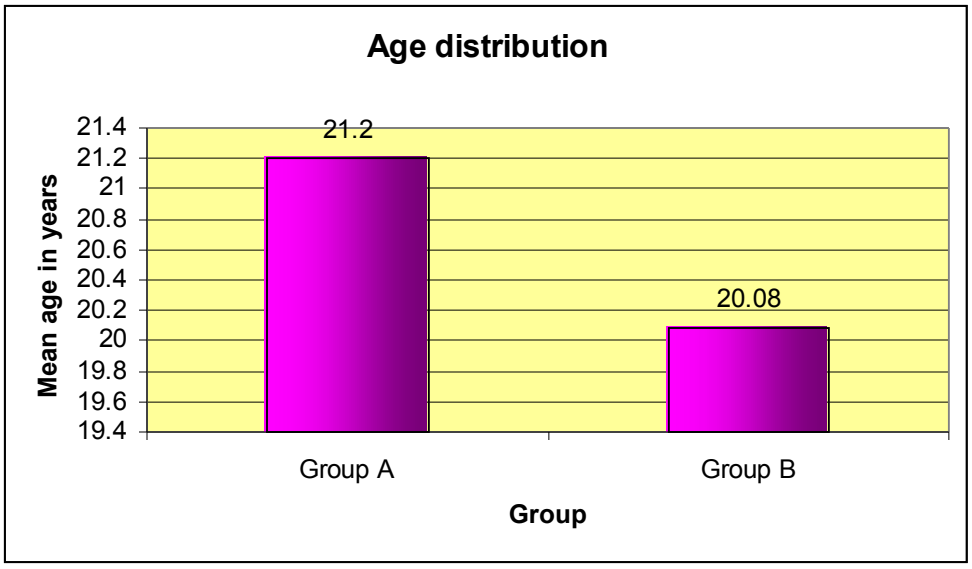


Figure 3 - Mean age distribution

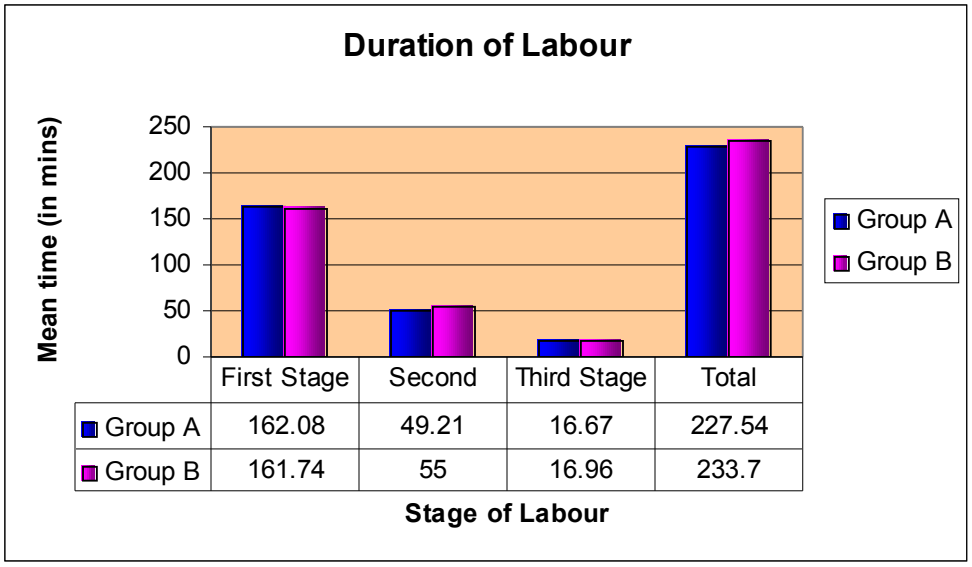


Figure 4- Duration of labour

TIME FROM EPIDURAL TO DELIVERY

The time from epidural to delivery in both groups were comparable. The Student t test done on the values revealed no statistical significance.

Table 6- Time from epidural to delivery

Group	No. of cases	Mean time from epidural to delivery in mins	SD	Student t test P value
Group A	24	161.8750	13.578	0.900 (Not Significant)
Group B	23	166.9565	13.878	

DURATION OF LABOUR

The total duration of labour in both groups were comparable. The duration of first and third stage of labour was comparable. Student T-test was done on duration on total and each stage of labour. The P-values were all >0.05 implying that differences were not statistically significant. Duration of the second stage of labour was significantly shorter in group A (P =0.009).

Table 7- Duration of labour

Stage of Labour	Group - A		Group - B		T-test	P-value
	Mean (mins)	SD	Mean (mins)	SD		
First Stage	162.08	11.83	161.74	10.18	0.11	0.916
Second Stage	49.21	7.65	55.00	6.74	2.75	0.009**
Third Stage	16.67	4.08	16.96	3.91	0.25	0.805
Total	227.54	16.12	233.70	14.16	1.39	0.172

**- Denotes significance at 1% level and 5% level

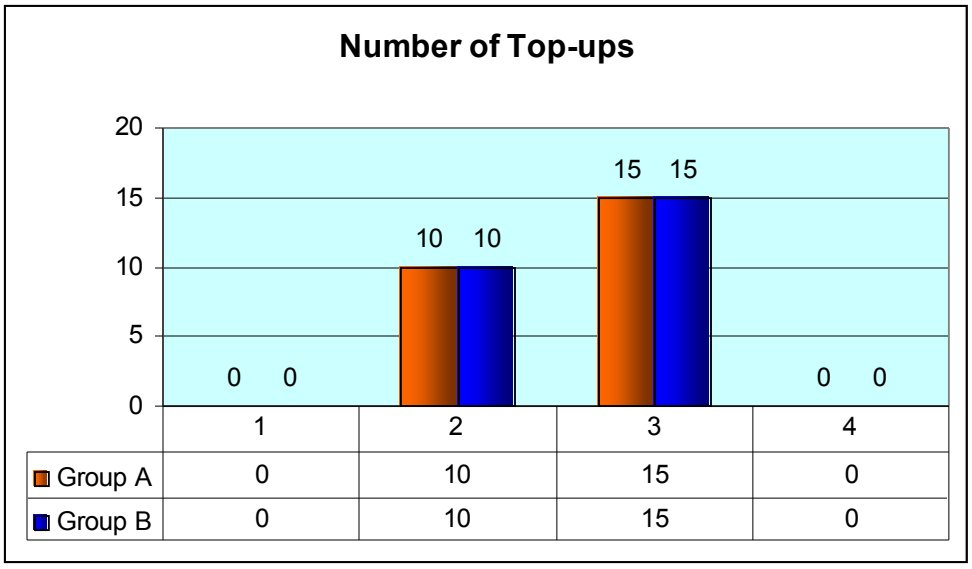


Figure 5- Number of top-ups

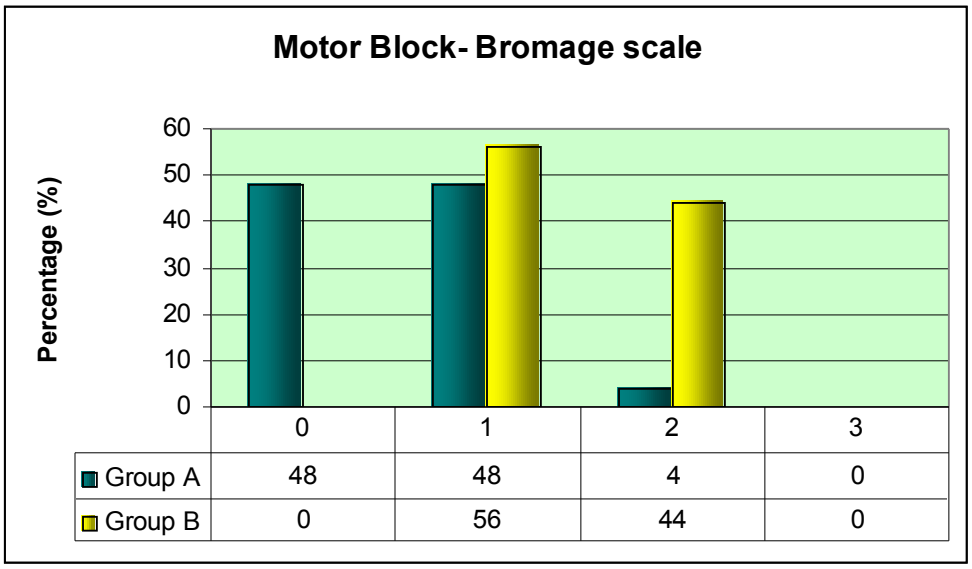


Figure 6- Motor block- Bromage score

NUMBER OF TOP-UPS GIVEN

Number of top-ups given in both groups were comparable. The Chi-Square test done on the values revealed no statistical significance.

Table 8- Number of top-ups

No. of top-ups	Group – A		Group - B	
	N	%	N	%
1	0	0	0	0
2	10	40	10	40
3	15	60	15	60
4	0	0	0	0
Chi-Square value	0.00000			
P value	1.00000 (Not Significant)			

MOTOR BLOCKADE

This was assessed using the Modified Bromage Scale. The patients in group A had minimal motor blockade when compared to patients in group B. The Chi-Square test showed statistical significance with regard to motor blockade between the two groups.

Table 9- Motor block- Bromage score

Bromage Scale	Group – A		Group - B	
	N	%	N	%
0	12	48	0	0
1	12	48	14	56
2	1	4	11	44
3	0	0	0	0
Chi-Square value	20.48718			
P value	0.00004 (Significant)			

VAS SCALE

The pain perceived by the patients was assessed by showing them a VAS scale which contained pictures of faces depicting pain on one end and smiling face on the other end. In between the two, there were pictures expressing intermediate emotions. The other side had a scale marked from 0 to 100. The scale had a slider which the patients move to point below the image which they felt expressed their perceived pain.

Table 10- VAS score

Time in mins	Group - A		Group - B		Student t test
	Mean	Std Deviation	Mean	Std Deviation	P value
0	94.00	7.07	94.00	7.07	1.000
5	57.60	11.65	56.80	10.69	0.794
15	11.60	8.50	15.40	7.90	1.000
30	0.20	1.00	5.80	5.72	0.000
45	10.20	6.20	13.00	6.45	0.102
60	12.20	8.05	13.60	7.43	0.847
120	11.40	10.16	12.80	8.55	0.787
180	9.00	4.79	11.80	4.54	0.707

The VAS score was assessed at 0, 5, 15, 30, 45, 60, 120 and 180 minutes. The initial VAS score ranged between 80 and 100 for all the patients. VAS score for pain was comparable in both groups throughout labour.

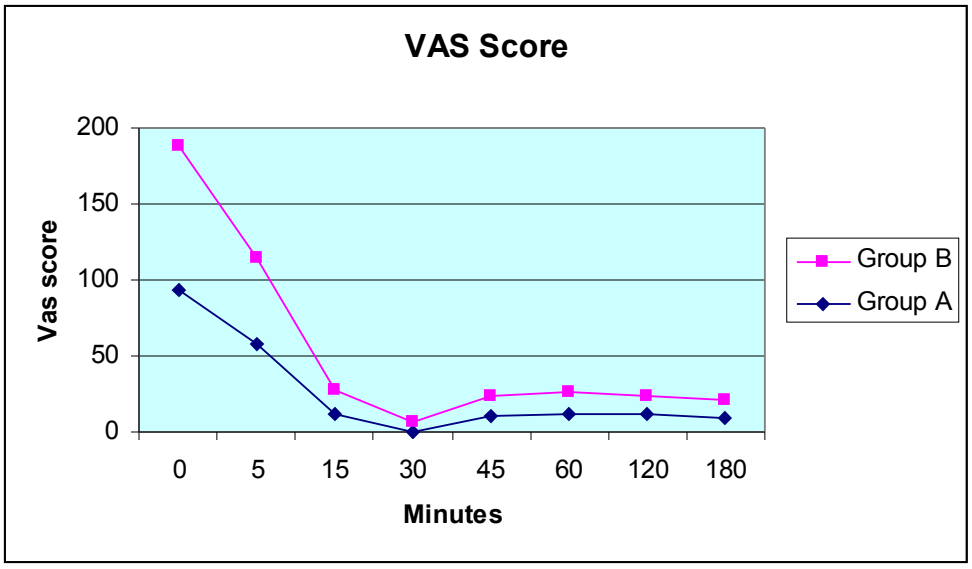


Figure 7- VAS score

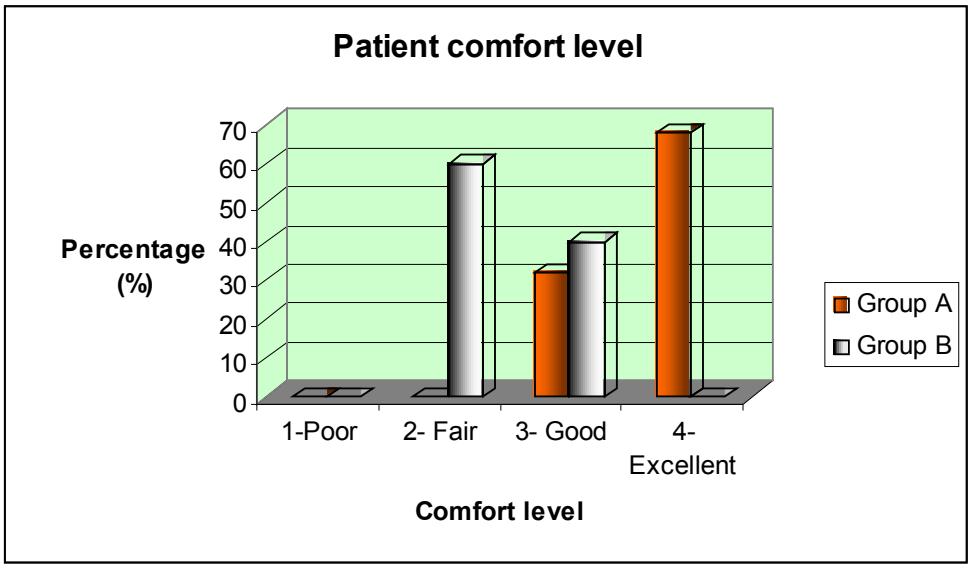


Figure 8- Patient comfort level

PATIENT COMFORT LEVEL

This was assessed by asking the patient how they felt at the end of the delivery. Majority of patients (68%) in group A had excellent pain relief. 32% of patients in group A had good pain relief. In group B, 60% of patients had fair pain relief and 40% of patients had good pain relief.

Table 11- Patient comfort level

Comfort level	Group – A		Group - B	
	N	%	N	%
1- Poor	0	0	0	0
2- Fair	0	0	15	60
3- Good	8	32	10	40
4- Excellent	17	68	0	0
Chi-Square value	32.2222			
P value	< 0.001 (Significant)			

UPPER SENSORY LEVEL

Patients in both groups had a mean sensory level of T9. The maximum was only T11 and minimum level was T8

Table 12- Upper sensory level

Sensory level	Group – A		Group - B	
	N	%	N	%
T6	0	0	0	0
T7	0	0	0	0
T8	5	20	6	24
T9	8	32	8	32
T10	7	28	8	32
T11	5	20	3	12

HAEMODYNAMIC VARIABLES

All haemodynamic variables were recorded at 0 mins (baseline), 5 mins, 15 mins, 30 mins, 45 mins, 60 mins and thereafter every 15 mins. For the purpose of statistical comparison after the first hour, only the hourly recording or that during every top-up was considered.

MATERNAL PULSE RATE

Pulse rate recordings were found to be comparable between the two groups.

The two way ANOVA test done on the pulse rate recordings showed no statistical difference between the two groups.

Table 13- Maternal pulse rate

Time in mins	Group – A		Group - B	
	Mean	Std Deviation	Mean	Std Deviation
0	90.26	11.14	91.44	9.57
2	92.43	9.65	93.28	9.57
5	91.48	12.11	89.36	7.20
15	91.83	9.44	89.12	7.66
30	90.87	6.20	86.40	6.03
45	90.09	6.59	85.84	4.93
60	89.74	8.10	87.60	3.61
2 hours	88.35	6.23	89.52	6.12
3 hours	88.48	9.12	89.76	2.07

Summary of ANOVA for 2X 10 factorial experiment with repeated measures on the second factor (10 times)

Sources of variation	Sum of square	DF	Mean square	F value	P value
Between drugs	174.68	1	174.68	0.39	0.53

SYSTOLIC BLOOD PRESSURE

Systolic blood pressure were normal i.e) > 100 mm of Hg in both the groups and was not statistically significant between the groups.

Table 14- Maternal systolic blood pressure

Time in mins	Group – A		Group - B	
	Systolic blood pressure Mean	Std Deviation	Systolic blood pressure Mean	Std Deviation
0	116	6.455	115.84	7.116
5	113.6	9.074	114.4	8.210
15	112.4	7.141	111.12	6.685
30	112.72	7.414	111.84	7.701
45	108.88	7.096	112.4	6.481
60	112.16	7.369	111.12	6.483
2 hours	112.56	9.028	107.24	7.674
3 hours	108.36	7.658	112.40	7.000

Summary of ANOVA for 2X 9 factorial experiment with repeated measures on the second factor (9 times)

Sources of variation	Sum of square	DF	Mean square	F value	P value
Between drugs	16245	2	8122.5	5.871	0.553
With time	8415.4	7	1202.2	0.8689	0.141

The two way ANOVA test showed no significant statistical difference between the two groups and also with time.

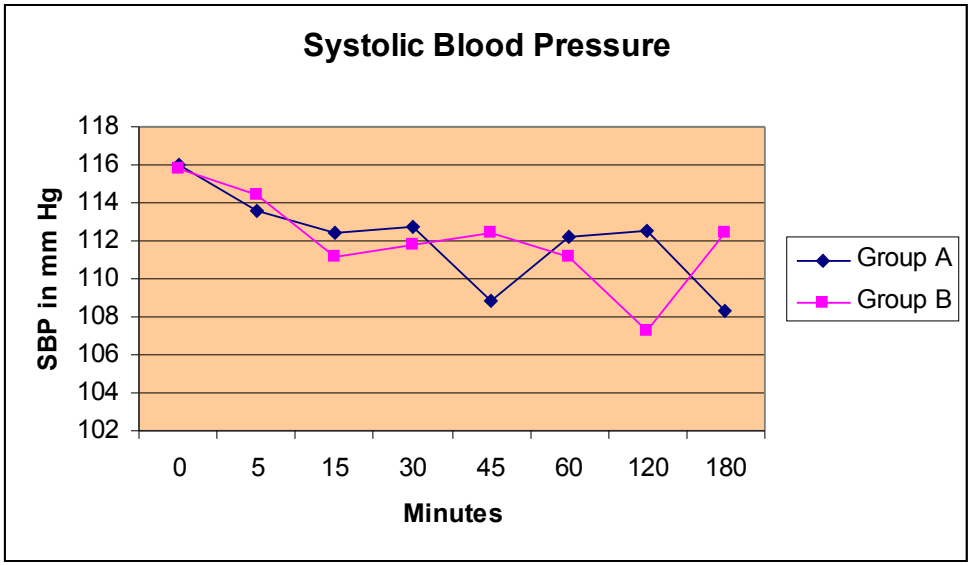


Figure 9- Maternal systolic blood pressure

DIASTOLIC BLOOD PRESSURE

The two groups had no significant difference in the diastolic blood pressure as was seen in the systolic blood pressure. The two way ANOVA test showed no statistical difference between the two groups.

Table 15- Maternal diastolic blood pressure

Time in mins	Group – A		Group - B	
	Diastolic blood pressure Mean	Std Deviation	Diastolic blood pressure Mean	Std Deviation
0	75.52	4.665	76.16	4.394
5	75.62	4.605	75.28	4.468
15	75.44	5.116	75.68	5.558
30	74.80	4.619	76.0	4.761
45	75.12	4.438	74.56	5.523
60	75.12	4.868	73.56	4.142
2 hours	76.16	4.394	76.16	4.580
3 hours	75.28	4.686	76.40	4.435

Summary of ANOVA for 2X 9 factorial experiment with repeated measures on the second factor (9 times)

Sources of variation	Sum of square	DF	Mean square	F value	P value
Between drugs	183.6	2	918.28	0.6980	0.5141
With time	9286.9	7	1326.7	1.008	0.4656

FOETAL HEART RATE

There was not much variation between the two groups and the ANOVA test did not show any statistical significance between the two groups.

Table 16- Foetal heart rate

Time in mins	Group – A		Group - B	
	mean foetal heart rate	Std Deviation	mean foetal heart rate	Std Deviation
0	142.17	8.65	142.24	15.66
5	140.87	11.08	145.28	6.29
15	138.87	7.16	151.00	6.01
30	142.26	6.16	146.00	8.10
45	145.65	7.92	142.92	4.64
60	145.22	9.74	146.72	4.58
2 hours	149.22	10.25	145.68	12.56
3 hours	144.70	12.19	152.88	5.23

Summary of ANOVA for 2X 9 factorial experiment with repeated measures on the second factor (9 times)

Sources of variation	Sum of square	DF	Mean square	F value	P value
Between drugs	945.96	1	945.96	7.3	0.08

APGAR SCORE

APGAR score estimated at one and five minutes are tabulated below.

Table 17- One minute APGAR

APGAR	Group – A		Group - B	
	N	%	N	%
5	0	0	0	0
6	2	8	5	20
7	11	44	6	24
8	12	48	14	56
9	0	0	0	0
10	0	0	0	0

P value by Chi square test did not show statistical difference.

Table 18- Five minute APGAR

APGAR	Group – A		Group - B	
	N	%	N	%
5	0	0	0	0
6	0	0	0	0
7	0	0	2	8
8	18	72	15	60
9	5	20	8	32
10	2	8	0	0

P value by Chi square test did not show statistical difference.

COMPLICATIONS

Hypotension (SBP <90 mm Hg or < 30% of baseline) was present in one case each in both the groups. Both cases responded to 6 mg of Ephedrine IV. Pruritus was present in one case each in both the groups. It was only mild and reassurance was all that was needed. One patient in group B had vomiting.

Table 19- Complications

COMPLICATION	Group – A	Group - B
Hypotension	1	1
Pruritus	1	1
Vomiting	0	1
Respiratory depression	0	0
Urinary retention	0	0

DISCUSSION

A number of methods exist to provide pain relief to the labouring parturient. Of the regional techniques, epidural analgesia is considered the gold standard among all other techniques and it is the only technique which can provide a complete and convincing pain relief making labour a pleasurable experience[41].

In our study, we have demonstrated that with an epidural top-up technique using 0.1% bupivacaine with fentanyl 2 microgram /ml (group A) analgesia was similar to that using 0.25% plain bupivacaine (group B), but motor power was retained allowing women to mobilize. There also appear to be beneficial effects on the progress of labour, with a clinically important reduction in the length of the second stage.

In our study, the patients in group A had minimal motor blockade when compared to patients in group B. This clinically significant motor blockade was supported statistically with a p-value of 0.00004 using chi-square test. Reduction in motor block allowing independent movement and awareness of contractions without pain has been shown to be popular with mothers. Retention of pelvic floor sensation and motor function may allow appropriate coordinated pushing during the second stage, improving rotation and descent of the fetal head through the pelvis. Epidural local anaesthetic may attenuate endogenous oxytocin production reducing uterine contractility during the second stage.

Both a long second stage and instrumental delivery have associated morbidity for the mother, pose a controversial potential risk to the baby and negatively influence maternal satisfaction with the experience of labour. Although epidural analgesia produces excellent analgesia, this does not automatically produce maternal satisfaction with labour, and less effective methods of analgesia have produced higher satisfaction with scores. We demonstrated high maternal satisfaction with both epidural solutions, which was significantly greater in bupivacaine-fentanyl group.

Analgesia was established by 30 min in all women. Establishing analgesia with an epidural bolus is effective but takes longer than a combined spinal-epidural technique, which has been described widely. However, it avoids the complications of deliberate dural puncture. The time difference between establishing spinal rather than epidural analgesia should be viewed in the context of the duration of labour and the potential complications of the spinal component of a combined technique.

The blood pressures (both systolic and diastolic) and pulse rate recorded during the analgesia in both the groups were not statistically significant. The APGAR score observed at 1 minute and 5 minutes showed no significant neonatal depression.

Complications were only few, were minor and easily manageable.

SUMMARY

In our study, comparison of epidural bolus administration of 0.25% bupivacaine and 0.1% bupivacaine with 0.0002% fentanyl for analgesia during labour was done. Patients were randomized to enter either group A treatment arm or group B treatment arm. Group A received bolus doses of 0.1% bupivacaine with fentanyl 2 micrograms/ml while group B received 0.25% plain bupivacaine.

Analgesia provided by both techniques was found to be similar. Women in group A retained motor power in their legs. Motor Block was minimized in Group A.

Duration of labour and time from insertion of the epidural to delivery was similar in both groups, but in group A, duration of the second stage was significantly shorter. In addition, maternal satisfaction with epidural analgesia was higher in group A.

Both the treatment arms had lesser impact on the haemodynamics.

Complications were only few, were minor and easily manageable.

CONCLUSION

In our study, we have shown that establishing epidural analgesia in labour with 15ml of 0.1% bupivacaine combined with fentanyl 50 microgram followed by top-ups of 10ml of 0.1% bupivacaine with 0.0002% fentanyl, produced similar analgesia to that obtained from the same volume of 0.25% bupivacaine alone, but motor block was minimized. This may influence the progress of labour, decreasing the duration of the second stage and produce high maternal satisfaction with the experience of labour.

In our study, the APGAR score observed at 1 minute and 5 minutes showed no significant neonatal depression.

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APPENDICES

Appendix 1

Informed Consent Form-English

STUDY TITLE:

Labour Analgesia- A comparative study between epidural bolus administration of 0.1% bupivacaine with 0.0002% fentanyl and 0.25% plain bupivacaine

Study centre:

Patient name:

Patient age:

Identification no:

Patient may check (√) these

I confirm that I have understood the purpose of the procedure of the above study. I have had the opportunity to ask questions and all my questions and doubts have been answered to my complete satisfaction.	
I understand that my participation in this study is voluntary and that I am free to withdraw at any time without giving any reason, without my legal rights being affected.	
I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethics committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from study. I agree to this access . However, I understand that my identity would not be revealed. In any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study.	
I agree to take part in the above study and to comply with the instructions given during the study and to faithfully to cooperate with the study team, and to immediately inform the study staff if I suffer from any deterioration in my health or my wellbeing or any unexpected or unusual symptoms.	
I hereby give consent to participate in the study "Labour Analgesia- A comparative study between epidural bolus administration of 0.1% bupivacaine with 0.0002% fentanyl and 0.25% plain bupivacaine ."	
I hereby give permission to undergo complete clinical examination, and diagnostic tests including hematological, biochemical, radiological and other investigation.	

Signature /Thumb impression of the patient:
Place -
Date –
Patient's Name and Address:

Signature of the Investigator:
Study Investigator's Name:

Appendix 2

PROFORMA

"LABOUR ANALGESIA- COMPARISION OF EPIDURAL BOLUS ADMINISTRATION OF 0.1% BUPIVACAINE WITH 0.0002% FENTANYL VS 0.25% PLAIN BUPIVACAINE"

Name
Age
Unit
IPNo
Date of Study

Height :
Weight :
Gestational Age:

Examination of Patient

PR :
BP:
VS:
RS:

Urine: Albumin/sugar-
Hb-

ASA Physical Status

Baseline status

- Visual analogue pain scale-
- Cervical dilatation-
- Foetal heart rate-

Parameters to be measured

Time for first painless Contraction
Motor Block (Bromage Score)
Time for onset for analgesia by skin prick
Upper sensory level
Time from epidural to delivery
Time between top-ups
Total Bupivacaine
Total Fentanyl
Quality of analgesia (VAS)
Duration of Labour 1st stage: 2nd stage: Total:

Complication

DuralPuncture
Venous Puncture
Pruritis
Nausea
Vomiting
Rigor
Drowsiness/sedation
Urinary retention
Hypotension
Respiratory depression

GROUP – A ---0.1% BUPIVACAINE WITH FENTANYL 2mcg/ml

S.No.	Name	Age	IP No	Weight in kg	Height in cm	Gestational age in weeks	Visual analogue pain scale	Cervical dilatation in cm	Foetal heart rate/min	Hb in gm %	Urine-albumin	Urine-sugar
1	Archana	19	14204	65	155	37	100	3	140	9.4	Nil	Nil
2	Revathy	22	13987	55	160	37	90	4	140	9.6	Nil	Nil
3	Sulochana Devi	18	14301	60	160	37	80	4	140	9.4	Nil	Nil
4	Anitha	28	14199	52	152	37	100	4	140	9.8	Trace	Nil
5	Ranjani	20	14323	60	155	37	100	3	130	9.8	Nil	Nil
6	Jeya	24	14226	65	155	37	90	4	150	9.6	Nil	Nil
7	Amudha	24	14366	58	155	37	100	3	126	10	Nil	Nil
8	Raziya Begum	19	14378	64	158	38	80	4	136	10.4	Nil	Nil
9	Geetha	24	14367	58	153	37	90	4	130	9.8	Nil	Nil
10	Priya	20	14405	72	156	37	100	3	130	9.8	Nil	Nil
11	Deepa	21	14402	69	163	37	100	4	130	10.6	Nil	Nil
12	Baby	19	14392	68	165	37	80	3	130	9.6	Nil	Nil
13	Seetha	18	14405	69	158	37	100	3	130	9.8	Nil	Nil
14	Ambika	19	14279	75	160	37	90	3	140	9.2	Nil	Nil
15	Gomathy	23	14417	68	165	37	100	3	120	9.6	Nil	Nil
16	Nasheema	22	14420	62	148	36	90	4	130	9.6	Nil	Nil
17	Vijayalakshmi	24	14430	64	158	36	90	3	140	9.4	Nil	Nil
18	Kalaiyarasi	22	14435	70	159	37	100	4	130	9.8	Nil	Nil
19	Sheela	23	14422	68	160	37	90	3	130	9.8	Nil	Nil
20	Kalaimathi	20	14505	69	162	37	90	4	130	9.6	Nil	Nil
21	Sangeetha	18	14519	69	164	37	100	4	126	9.4	Nil	Nil
22	Muthulakshmi	23	14526	62	156	37	90	3	128	9.4	Nil	Nil
23	Devi	22	14524	59	152	37	100	4	125	9.8	Nil	Nil
24	Usha	19	14575	68	165	37	100	4	130	9.6	Nil	Nil
25	Esther Mary	19	14584	62	164	36	100	3	125	10	Nil	Nil

GROUP – A ---0.1% BUPIVACAINE WITH FENTANYL 2mcg/ml

S. N.	Name	VAS scores (at minutes)								Time for first painless Contraction in mins	Bromage Score	Time for onset for analgesia in mins	Upper sensory level	Time-epidural to delivery in mins
		0	5	15	30	45	60	120	180					
1	Archana	100	60	10	0	10	10	10	10	15	1	8	T9	120
2	Revathy	90	50	20	0	20	10	10	10	10	1	6	T9	140
3	Sulochana Devi	80	60	20	0	20	20	20	10	11	0	7	T10	160
4	Anitha	100	60	20	0	10	20	20	5	10	1	6	T10	160
5	Ranjani	100	60	0	0	5	5	5	5	11	0	7	T10	160
6	Jeya	90	40	10	0	0	5	10	10	11	1	7	T8	180
7	Amudha	100	60	10	0	0	5	5	5	13	1	8	T10	170
8	Raziya Begum	80	70	10	0	10	10	5	5	13	0	8	T11	180
9	Geetha	90	60	10	0	10	10	5	5	12	1	7	T8	170
10	Priya	100	40	10	5	30	10	5	5	12	0	8	T11	175
11	Deepa	100	60	0	0	10	10	10	10	12	0	8	T8	160
12	Baby	80	50	10	0	0	40	5	5	13	0	9	T10	180
13	Seetha	100	60	20	0	10	10	5	5	12	0	8	T9	170
14	Ambika	90	80	10	0	10	5	5	10	12	1	8	T11	150
15	Gomathy	100	60	20	0	10	5	5	5	13	0	8	T10	Nil
16	Nasheema	90	80	10	0	10	5	5	10	12	1	9	T8	165
17	Vijayalakshmi	90	60	0	0	10	10	5	10	12	0	8	T9	150
18	Kalaiyarasi	100	70	0	0	10	10	5	10	11	0	7	T8	160
19	Sheela	90	40	10	0	10	5	10	10	13	0	8	T9	170
20	Kalaimathi	90	70	0	0	10	10	10	10	13	1	8	T11	165
21	Sangeetha	100	40	0	0	10	20	50	20	15	1	8	T9	165
22	Muthulakshmi	90	40	20	0	10	10	10	10	11	1	7	T9	155
23	Devi	100	50	30	0	10	20	20	5	13	0	9	T11	150
24	Usha	100	60	20	0	10	20	25	25	13	1	8	T9	160
25	Esther Mary	100	60	20	0	10	20	20	10	12	2	8	T10	170

		Time between top-ups in mins	Total Bupivacaine mg	Total Fentanyl µg	Comfort level	Duration of Labour in mins				Mode of delivery
						1st stage	2nd stage	3rd stage	Total	
1	Archana	60	20 mg	60	3	140	50	10	200	LN
2	Revathy	65	20 mg	60	3	180	60	15	255	Labour naturale
3	Sulochana Devi	70	20 mg	60	4	160	45	15	220	Labour naturale
4	Anitha	45	30 mg	70	4	160	40	15	215	Labour naturale
5	Ranjani	45	30 mg	70	4	160	50	15	225	Labour naturale
6	Jeya	45	30mg	70	4	180	50	20	250	Labour naturale
7	Amudha	45	30mg	70	4	150	45	20	215	Labour naturale
8	Raziya Begum	50	30mg	70	4	150	50	20	220	Labour naturale
9	Geetha	60	20 mg	60	4	170	65	15	250	Labour naturale
10	Priya	50	30mg	70	3	170	60	20	250	Labour naturale
11	Deepa	60	20mg	60	4	180	50	20	250	Labour naturale
12	Baby	55	30mg	70	3	170	40	20	230	Labour naturale
13	Seetha	55	30mg	70	3	160	40	25	225	Labour naturale
14	Ambika	60	20 mg	60	4	150	40	20	210	Labour naturale
15	Gomathy	45	20 mg	60	3	NA	NA	NA	NA	Caeserean section
16	Nasheema	45	30 mg	70	3	154	56	15	225	Labour naturale
17	Vijayalakshmi	45	30 mg	70	4	148	60	20	228	Labour naturale
18	Kalaiyarasi	45	30 mg	70	4	172	45	10	217	Labour naturale
19	Sheela	50	30 mg	70	4	158	50	10	218	Labour naturale
20	Kalaimathi	50	30 mg	70	4	150	40	15	205	Labour naturale
21	Sangeetha	55	30 mg	70	4	150	45	10	205	Labour naturale
22	Muthulakshmi	60	20 mg	60	4	164	50	20	234	Labour naturale
23	Devi	60	20 mg	60	4	160	60	15	235	Labour naturale
24	Usha	60	20 mg	60	3	178	40	15	233	Labour naturale
25	Esther Mary	55	30 mg	70	4	176	50	20	246	Labour naturale

GROUP – A ---0.1% BUPIVACAINE WITH FENTANYL 2mcg/ml

S.No.	Name	Maternal Systolic Blood Pressure in mg (at minutes)								Maternal Diastolic Blood Pressure in mg (at minutes)							
		0	5	15	30	45	60	120	180	0	5	15	30	45	60	120	180
1	Archana	120	110	110	110	100	110	110	110	80	80	70	80	70	80	70	70
2	Revathy	110	110	120	110	120	100	110	120	70	60	80	70	80	70	70	80
3	Sulochana Devi	120	120	110	110	100	120	120	120	70	80	70	80	70	70	70	70
4	Anitha	120	110	80	90	90	120	110	100	80	70	50	60	60	80	70	80
5	Ranjani	120	110	110	100	120	120	120	120	80	80	60	70	70	80	88	80
6	Jeya	110	120	120	110	120	120	120	110	70	80	60	70	80	80	80	80
7	Amudha	110	120	120	110	120	120	110	110	70	80	70	70	80	70	70	70
8	Raziya Begum	120	120	110	120	130	120	120	110	70	80	60	70	80	70	60	70
9	Geetha	120	110	130	120	110	110	100	110	70	80	60	70	80	60	70	70
10	Priya	120	120	110	110	110	120	120	120	80	70	80	70	70	70	70	70
11	Deepa	110	110	120	110	110	120	100	110	70	80	70	60	70	80	70	70
12	Baby	120	120	130	110	110	120	120	120	70	80	80	80	70	70	80	80
13	Seetha	110	100	120	130	120	120	110	110	70	60	70	80	80	70	80	70
14	Ambika	110	120	120	120	110	120	110	106	70	80	60	70	70	70	80	70
15	Gomathy	120	110	100	120	100	110	120	120	70	70	80	70	60	70	80	70
16	Nasheema	110	120	110	120	100	130	130	120	70	80	80	70	70	80	80	70
17	Vijayalakshmi	110	130	120	120	130	120	110	110	70	80	60	70	70	80	70	70
18	Kalaiyarasi	120	110	120	120	110	120	120	110	70	80	80	70	80	70	70	80
19	Sheela	110	120	120	130	120	130	120	110	70	80	80	80	70	80	70	80
20	Kalaimathi	120	110	120	110	120	120	110	120	70	70	80	70	80	70	80	80
21	Sangeetha	120	110	120	110	110	120	120	120	80	70	80	80	70	70	80	70
22	Muthulakshmi	120	110	120	110	120	130	120	120	80	70	60	70	80	80	80	80
23	Devi	120	120	110	130	140	110	120	100	80	70	80	80	90	70	80	60
24	Usha	120	110	130	120	120	120	120	120	70	80	70	80	80	70	80	70
25	Esther Mary	120	110	110	120	130	120	100	110	80	70	70	80	80	70	60	70

GROUP – A ---0.1% BUPIVACAINE WITH FENTANYL 2mcg/ml

S.No.	Name	Maternal pulse rate (at minutes)								Foetal heart rate (at minutes)							
		0	5	15	30	45	60	120	180	0	5	15	30	45	60	120	180
1	Archana	98	96	94	84	84	82	82	80	140	150	144	144	144	144	144	150
2	Revathy	94	92	90	84	86	84	82	80	152	148	144	144	144	146	144	142
3	Sulochana Devi	98	92	86	94	92	88	86	88	140	145	144	146	144	144	144	146
4	Anitha	90	88	89	90	88	84	88	86	150	140	145	146	144	142	130	140
5	Ranjani	80	84	82	86	94	94	94	94	140	150	144	144	144	144	142	140
6	Jeya	108	106	104	90	80	85	84	84	140	136	125	125	128	140	140	142
7	Amudha	108	104	80	80	76	84	82	82	126	132	125	140	130	130	130	130
8	Raziya Begum	108	106	90	88	86	84	80	84	136	125	140	145	130	140	130	135
9	Geetha	110	104	88	86	84	82	84	80	130	135	136	140	142	144	120	140
10	Priya	112	110	96	80	84	82	84	82	130	135	125	145	140	140	130	125
11	Deepa	120	120	114	116	90	86	84	86	130	140	120	125	128	134	144	142
12	Baby	104	102	96	98	90	80	82	82	130	125	130	120	140	125	130	135
13	Seetha	102	104	100	90	84	82	84	82	130	120	140	125	130	125	130	125
14	Ambika	104	102	94	90	86	80	84	82	140	130	145	145	130	130	145	120
15	Gomathy	88	86	84	82	84	80	82	84	120	125	126	130	125	125	130	135
16	Nasheema	104	102	104	102	88	84	86	84	130	135	140	125	130	125	130	130
17	Vijayalakshmi	106	104	88	84	82	80	84	80	140	145	130	135	120	120	130	135
18	Kalaiyarasi	102	104	90	88	88	84	82	84	130	128	135	120	125	125	130	135
19	Sheela	102	100	94	96	84	82	84	86	130	135	125	125	130	135	125	130
20	Kalaimathi	108	104	96	88	84	82	84	82	130	135	140	135	125	130	130	135
21	Sangeetha	101	100	96	94	80	82	76	78	126	128	135	110	140	130	135	125
22	Muthulakshmi	108	106	102	96	98	80	84	82	128	135	132	135	125	140	135	125
23	Devi	104	100	96	94	88	82	84	80	125	135	120	132	134	140	125	120
24	Usha	96	94	92	88	82	84	80	84	130	135	128	130	135	145	125	100
25	Esther Mary	112	106	102	96	80	84	82	86	120	125	130	135	120	140	135	140

GROUP – B--0.25% Plain BUPIVACAINE

S.No.	Name	Age	IP No	Weight in kg	Height in cm	Gestational age in weeks	Visual analogue pain scale	Cervical dilatation in cm	Foetal heart rate min	Hb in gm %	Urine -albumin	Urine -sugar
1	Kanchana	25	13969	68	150	37	100	4	130	9.4	Nil	Nil
2	Lakshmi	19	14075	66	156	37	100	3	100	9.8	Nil	Nil
3	Saritha	19	14017	64	160	37	100	3	140	9.6	Nil	Nil
4	Indumathy	21	13949	70	159	37	90	4	140	9.2	Nil	Nil
5	Tajunisha	20	14079	68	159	37	100	4	140	9.8	Nil	Nil
6	Sonia	19	14080	67	157	37	90	3	130	9.6	Nil	Nil
7	Sangeetha	18	14052	72	160	37	90	4	90	10	Nil	Nil
8	Shanthi	21	14084	74	162	37	100	3	140	10.4	Nil	Nil
9	Valli	20	14068	64	158	37	90	4	140	9.2	Nil	Nil
10	Tamilarasi	18	14077	69	159	37	90	4	144	9.6	Nil	Nil
11	Bhavani	20	14118	63	170	37	100	4	156	9.8	Nil	Nil
12	Suganya	18	14113	60	160	37	90	3	148	10.2	Nil	Nil
13	Haj Sharmila	20	14087	62	153	37	100	4	140	10	Nil	Nil
14	Kalaiselvi	22	14145	68	162	37	80	4	156	9.8	Nil	Nil
15	Rajeshwari	23	14151	70	154	37	100	3	144	9.6	Trace	Nil
16	Prema	18	14167	65	163	37	100	4	148	9.6	Nil	Nil
17	Ayesha Begum	21	14197	70	162	37	90	4	140	9.8	Nil	Nil
18	Vimala	18	14211	59	156	37	80	3	148	9.4	Nil	Nil
19	Anitha	23	14209	73	144	37	100	4	140	10	Nil	Nil
20	Barnees Susanna	20	14223	54	154	37	90	3	144	11	Nil	Nil
21	Jeyalakshmi	20	14210	55	147	37	100	4	160	9.4	Nil	Nil
22	Renuka	19	14245	59	152	37	100	3	148	9.8	Nil	Nil
23	Nithya	21	14250	62	147	37	80	4	160	9.6	Nil	Nil
24	Jeyachitra	18	14251	60	154	37	90	4	140	10.2	Nil	Nil
25	Anandhi	21	14229	55	163	37	100	3	140	10.4	Nil	Nil

S.No.	Name	VAS scores (at minutes)								Time for first painless Contraction mins	Bromage Score	Time for onset for analgesia in mins	Upper sensory level	Time from epidural delivery mins
		0	5	15	30	45	60	120	180					
1	Kanchana	100	60	30	10	10	20	20	20	13	1	7	T10	175
2	Lakshmi	100	60	30	0	20	20	30	10	14	2	6	T8	165
3	Saritha	100	50	30	0	20	20	20	10	14	2	8	T9	155
4	Indumathy	90	40	25	10	20	20	10	10	12	1	7	T10	160
5	Tajunisha	100	40	10	0	10	20	40	20	16	2	8	T8	Nil
6	Sonia	90	70	10	0	10	10	10	20	14	2	6	T9	170
7	Sangeetha	90	40	20	0	20	10	10	10	12	1	7	T11	175
8	Shanthi	100	70	0	0	10	10	5	10	13	1	6	T9	165
9	Valli	90	60	10	0	10	10	5	15	13	2	8	T9	155
10	Tamilarasi	90	60	10	0	10	5	5	10	14	1	7	T8	170
11	Bhavani	100	60	20	10	10	10	20	10	13	1	7	T10	170
12	Suganya	90	80	10	10	10	5	5	10	13	2	8	T10	155
13	Haj Sharmila	100	60	20	10	10	10	5	5	14	1	8	T8	175
14	Kalaiselvi	80	50	10	10	10	40	10	10	13	1	6	T11	185
15	Rajeshwari	100	60	10	0	10	10	10	10	13	1	8	T9	Nil
16	Prema	100	40	10	5	30	10	10	10	13	1	9	T8	180
17	Ayesha Begum	90	60	10	0	10	10	5	5	14	2	9	T10	175
18	Vimala	80	70	10	20	20	10	10	10	14	1	7	T9	185
19	Anitha	100	60	10	10	0	10	10	10	12	2	8	T8	175
20	Barnees Susanna	90	40	10	10	5	10	20	20	12	1	8	T11	185
21	Jeyalakshmi	100	60	10	0	10	10	10	10	11	1	9	T9	165
22	Renuka	100	60	20	10	10	20	10	10	12	2	8	T10	165
23	Nithya	80	60	20	10	20	20	20	20	11	2	8	T10	165
24	Jeyachitra	90	50	20	10	20	10	10	10	16	2	9	T10	145
25	Anandhi	100	60	20	10	10	10	10	10	14	1	7	T9	125

GROUP – B--0.25% Plain BUPIVACAINE

S.No.	Name	Time between top-ups in mins	Total Bupivacaine	Total Fentanyl	Comfort level	Duration of Labour in mins				Mode of delivery
						1st stage	2nd stage	3rd stage	Total	
1	Kanchana	55	30 mg	Nil	2	175	55	20	250	Labour naturale
2	Lakshmi	60	20 mg	Nil	3	175	45	15	235	Labour naturale
3	Saritha	55	20 mg	Nil	3	160	65	15	240	Labour naturale
4	Indumathy	60	20 mg	Nil	2	160	60	15	235	Labour naturale
5	Tajunisha	50	30 mg	Nil	2	NA	NA	NA	NA	Caeserean section
6	Sonia	55	30 mg	Nil	2	150	55	20	225	Labour naturale
7	Sangeetha	55	30 mg	Nil	3	150	50	10	210	Labour naturale
8	Shanthi	50	30 mg	Nil	3	160	60	15	235	Labour naturale
9	Valli	50	30 mg	Nil	3	170	55	10	235	Labour naturale
10	Tamilarasi	50	30 mg	Nil	2	150	65	10	225	Forceps delivery
11	Bhavani	50	20 mg	Nil	2	150	60	20	230	Labour naturale
12	Suganya	65	20 mg	Nil	3	160	65	15	240	Labour naturale
13	Haj Sharmila	60	30 mg	Nil	2	150	50	15	215	Labour naturale
14	Kalaiselvi	60	30 mg	Nil	3	160	50	20	230	Labour naturale
15	Rajeshwari	65	20 mg	Nil	2	NA	NA	NA	NA	Caeserean section
16	Prema	55	30 mg	Nil	2	170	50	25	245	Labour naturale
17	Ayesha Begum	65	20 mg	Nil	2	180	60	20	260	Labour naturale
18	Vimala	55	30 mg	Nil	2	170	65	20	255	Labour naturale
19	Anitha	50	30 mg	Nil	2	170	60	20	250	Labour naturale
20	Barnees Susanna	50	30 mg	Nil	3	150	50	15	215	Forceps delivery
21	Jeyalakshmi	50	30 mg	Nil	2	150	45	20	215	Labour naturale
22	Renuka	50	30 mg	Nil	2	180	55	20	255	Labour naturale
23	Nithya	75	20 mg	Nil	2	160	50	20	230	Labour naturale
24	Jeyachitra	70	20 mg	Nil	3	160	45	15	220	Labour naturale
25	Anandhi	65	20 mg	Nil	3	160	50	15	225	Labour naturale

GROUP – B--0.25% Plain BUPIVACAINE

S.No.	Name	Maternal Systolic Blood Pressure in mg (at minutes)								Maternal Diastolic Blood Pressure in mg (at minutes)							
		0	5	15	30	45	60	120	180	0	5	15	30	45	60	120	180
1	Kanchana	110	120	110	100	110	110	120	110	70	80	70	80	70	80	70	70
2	Lakshmi	120	110	110	110	100	110	100	110	80	70	80	70	80	70	78	70
3	Saritha	110	130	100	100	110	100	110	110	80	78	70	80	70	80	80	80
4	Indumathy	130	120	100	100	120	110	100	100	80	80	60	80	70	80	70	80
5	Tajunisha	110	110	110	110	100	120	100	120	70	80	78	80	80	80	80	80
6	Sonia	120	100	120	120	110	130	120	100	78	70	80	80	70	80	70	70
7	Sangeetha	118	100	110	110	100	110	100	110	80	70	70	70	70	80	70	70
8	Shanthi	108	110	110	110	110	120	110	110	70	80	80	70	70	70	70	70
9	Valli	110	120	110	110	120	136	100	110	78	80	78	80	70	70	70	70
10	Tamilarasi	120	110	110	110	100	116	120	110	70	80	80	70	80	70	70	70
11	Bhavani	110	110	100	110	110	100	114	120	80	80	78	70	70	80	70	70
12	Suganya	130	100	110	110	100	110	110	110	70	80	70	70	80	70	70	70
13	Haj Sharmila	110	110	110	110	110	110	110	110	70	78	80	70	80	70	70	70
14	Kalaiselvi	120	110	100	118	120	100	120	120	70	80	70	70	82	70	70	70
15	Rajeshwari	110	100	120	120	100	110	100	120	70	82	78	80	80	70	70	70
16	Prema	110	110	110	100	110	120	110	108	80	80	80	80	80	70	70	70
17	Ayesha Begum	120	110	100	110	100	110	110	120	70	70	80	70	70	70	70	70
18	Vimala	110	110	120	110	100	120	110	129	70	80	70	80	72	70	70	70
19	Anitha	130	110	110	120	110	100	120	100	70	80	70	80	80	80	70	70
20	Barnees Susanna	110	130	110	110	110	110	110	110	80	80	76	70	80	80	70	70
21	Jeyalakshmi	110	110	110	100	100	110	100	120	78	70	78	70	82	80	70	70
22	Renuka	110	100	100	120	130	110	120	110	80	70	80	80	78	70	70	70
23	Nithya	110	110	110	110	110	100	110	100	70	78	86	80	80	80	72	72
24	Jeyachitra	110	120	100	100	110	108	120	100	70	70	70	80	80	80	78	78
25	Anandhi	110	110	110	120	110	100	110	110	80	70	70	80	80	80	72	78

GROUP – B--0.25% Plain BUPIVACAINE

S.No.	Name	Maternal pulse rate (at minutes)								Foetal heart rate (at minutes)							
		0	5	15	30	45	60	120	180	0	5	15	30	45	60	120	180
1	Kanchana	70	84	80	84	84	80	70	80	130	140	150	158	170	140	140	140
2	Lakshmi	90	100	110	100	80	84	90	90	100	152	152	144	156	160	160	160
3	Saritha	90	96	90	90	90	90	92	92	140	152	140	144	144	160	152	152
4	Indumathy	90	96	90	90	90	90	92	90	140	144	140	144	144	140	152	152
5	Tajunisha	90	96	86	80	80	90	90	90	140	132	148	144	152	144	158	158
6	Sonia	86	90	90	92	96	90	90	90	130	146	140	110	152	130	160	160
7	Sangeetha	106	90	80	90	94	90	96	90	90	152	144	108	128	140	140	140
8	Shanthi	96	80	90	90	96	90	90	90	140	156	160	114	128	140	140	140
9	Valli	86	80	90	86	80	86	92	90	140	152	132	118	144	140	140	140
10	Tamilarasi	96	80	90	92	80	90	96	90	144	146	144	120	140	140	140	140
11	Bhavani	106	80	80	96	78	88	70	90	156	146	144	140	140	138	140	140
12	Suganya	110	96	80	80	80	96	90	90	148	160	140	160	140	140	138	138
13	Haj Sharmila	88	80	88	78	80	88	90	90	140	144	138	148	136	140	118	118
14	Kalaiselvi	86	82	82	80	78	82	92	92	156	140	140	110	140	140	120	120
15	Rajeshwari	70	88	80	80	80	84	88	90	144	139	140	100	140	140	128	128
16	Prema	72	90	82	86	80	88	90	90	148	148	140	110	140	140	110	110
17	Ayesha Begum	86	86	88	84	82	86	90	92	140	150	140	130	135	140	140	140
18	Vimala	86	88	88	86	80	88	84	90	148	148	140	130	140	140	130	130
19	Anitha	86	86	80	88	80	90	80	90	140	140	140	130	130	140	120	120
20	Barnees Susanna	88	78	80	80	83	82	88	80	144	140	140	130	140	130	130	130
21	Jeyalakshmi	80	80	110	114	82	80	72	80	160	140	140	130	140	140	130	130
22	Renuka	120	110	78	90	80	82	96	90	148	140	140	130	140	148	130	130
23	Nithya	114	106	80	90	80	86	90	80	160	140	140	130	140	130	130	130
24	Jeyachitra	114	110	80	88	80	88	92	88	140	150	150	140	140	136	146	140
25	Anandhi	108	109	80	86	80	86	78	90	140	140	150	140	136	140	140	146